National Journal of Maxillofacial Surgery
Official Publication of Maxillofacial Society of India
Home
Current issue
Instructions
Submit article

Natl J Maxillofac Surg. 2017 Jul-Dec; 8(2): 106–109.
doi: 10.4103/njms.NJMS_36_17
PMCID: PMC5773983
PMID: 29386812

The effect of sodium bicarbonate oral rinse on salivary pH and oral microflora: A prospective cohort study

Siddhartha Chandel, Mohsin Ali Khan,[1] Nishi Singh,[2] Amiya Agrawal,[3] and Vinita Khare[4]

Department of Dentistry, Era's Lucknow Medical College, Lucknow, UP, India
[1]Research Cell, Era's Lucknow Medical College, Lucknow, UP, India
[2]Department of Periodontics, Career Dental College and Hospital, Lucknow, UP, India
[3]Department of Trauma and Emergency, KGMU, Lucknow, UP, India
[4]Department of Biochemistry, Era's Lucknow Medical College, Lucknow, UP, India
Address for correspondence: Dr. Siddhartha Chandel, Associate Professor, Department of Dentistry, Era's Lucknow Medical College, Lucknow, India. E-mail: siddhartha.chandel@gmail.com

Abstract

Aim:

Present study is designed to explore the effect of sodium bicarbonate oral rinse on salivary pH and oral micro flora.

Materials and Methods:

Twenty five healthy subjects were recruited for the study in department of dentistry in Era Medical College. Subjects were abstained from tooth brushing overnight pre rinse (control) samples were collected after one hour of dinner and were asked to rinse with pre calibrated freshly prepared sodium bicarbonate solution. The salivary samples were then collected the following morning using sterile gauze in marked bottles. Aerobic bacterial culture was done by plating the sample directly from the swab on the surface of Blood agar and Mac Conkeys media respectively. The colony forming units and ph were calculated for the pre rinse and post rinse saliva sample.

Result:

Results shows that salivary pH increased significantly after sodium Bicarbonate oral rinse. There was a marginal decrease in number of CFU/ml for bacteria especially Viridans Streptococci, Moraxella species.

Conclusion:

Sodium Bicarbonate oral rinse may be considered as a cheap and effective alternative for chlorhexidine

and alcohol based mouth wash, especially where long duration usage is required.

Keywords: Oral Microflora, salivary pH, sodium bicarbonate

INTRODUCTION

In present day practice, dental plaque has been established as the chief causative agent for dental caries. To understand the disease pathophysiology, it is considered that fermentation, which yields strong organic acids such as lactic acid along with other acids helps in promoting acidic environment that causes dissolution of the tooth enamel causing caries. Stephan in his time honored study has shown that plaque on tooth surface, when exposed to sucrose, can accelerate acid production, resulting in pH drop which could only be gradually restored to the baseline plaque pH.[1]

Till date, an array of medicated as well as nonmedicated solutions utilizing antimicrobial, anti-inflammatory properties, mucosal coating, or recent advances such as cryotherapy, lasers, and growth factors have been used, but the effectiveness of such therapies is still obscure. Moreover, cost factor of such medications is a major hindrance in their introduction in clinical practice. On the other hand, bland oral rinses such as 0.9% saline solution, sodium bicarbonate (SB) solution, or saline-SB solution have been introduced for oral health care which not only promote patient comfort but also help in maintaining moisture content of the oral epithelial barriers, and thus, also help in reduction of secondary infection risk. SB does not have any direct antimicrobial effects but has an active role as a cleansing agent because of its ability to dissolve mucus and loosen debris. However, the role of SB oral rinse in lowering the salivary pH and in turn preventing the overgrowth of aciduric bacteria needs to be confirmed. With this perspective in mind, this study is planned to unravel the association between salivary pH and SB oral rinse.

MATERIALS AND METHODS

Patient selection: Only healthy controls were included in the study. Patients suffering from any systemic disease, undergoing radiotherapy, chemotherapy, or using any systemic or topical medication were excluded from the study. Patients using tobacco, alcohol, or any other drugs in any form were excluded from the study.

Methodology: Collection of saliva samples

Step 1: SB solution was prepared by mixing approximately 3 g SB powder in 50 ml of water which was premeasured and marked on plastic glasses [Figures 1 and 2].

Natl J Maxillofac Surg
Natl J Maxillofac Surg

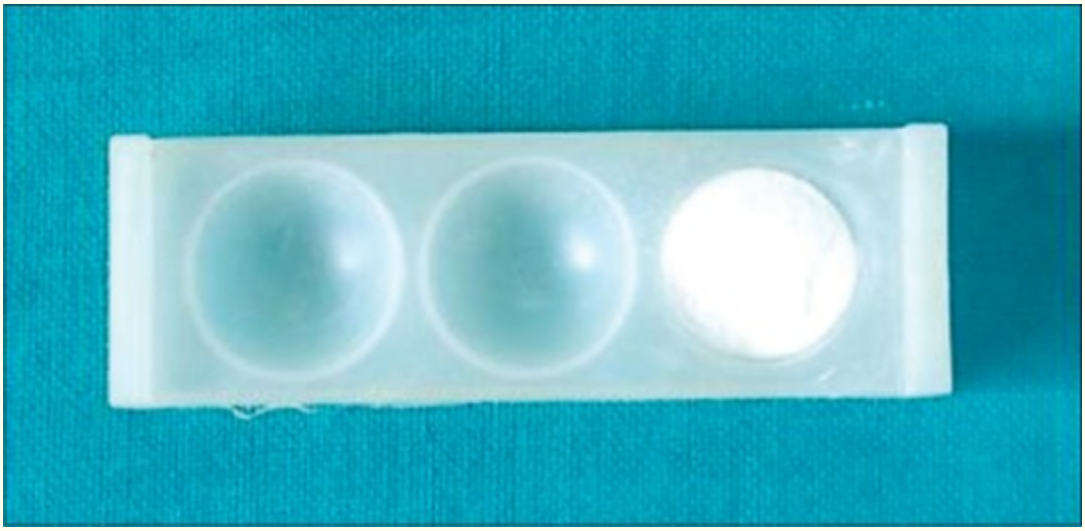

Figure 1

Half tablespoon (approximately 3 g) sodium bicarbonate powder

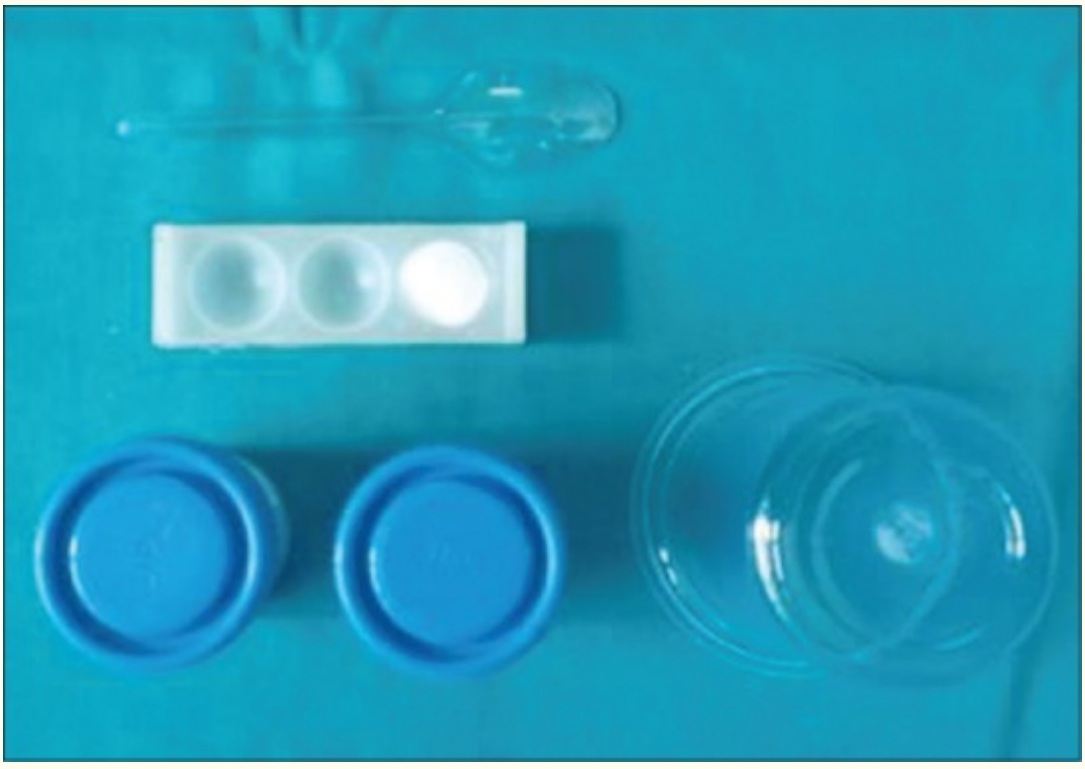

Figure 2

Fifty milliliters of water/marked with blue on plastic glass

Step 2: Instructions given to patients for the collection of saliva sample:

1. Patients were instructed to avoid brushing in the night

2. Patients were further instructed to collect saliva with the help of sterile cotton swab [Figure 3]

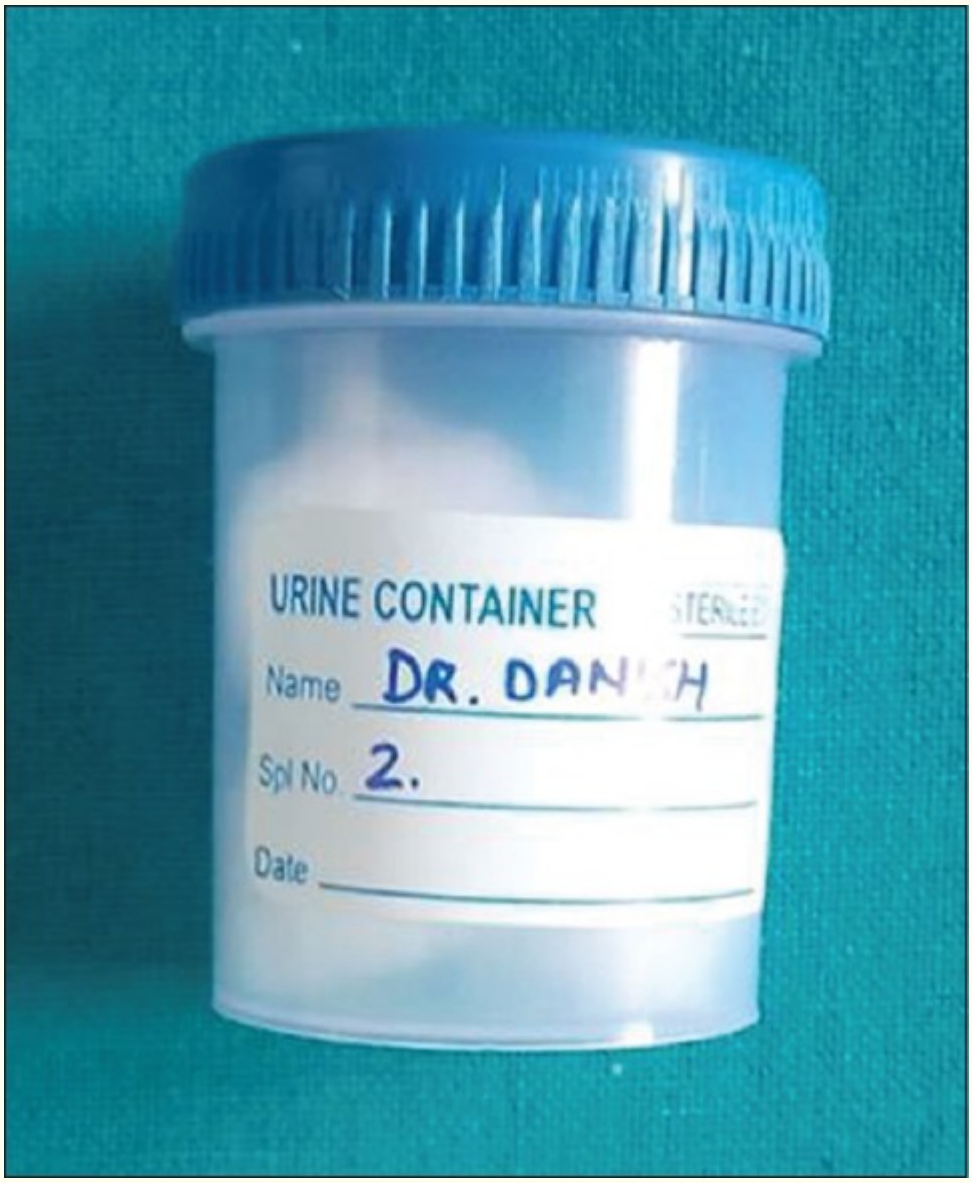

Figure 3

Prerinse saliva sample bottle (with sterile cotton)

3. Subsequent morning they were instructed to rinse with the freshly prepared SB solution

4. Participants were requested to collect the postrinse saliva samples with the help of sterile cotton gauge [Figure 4].

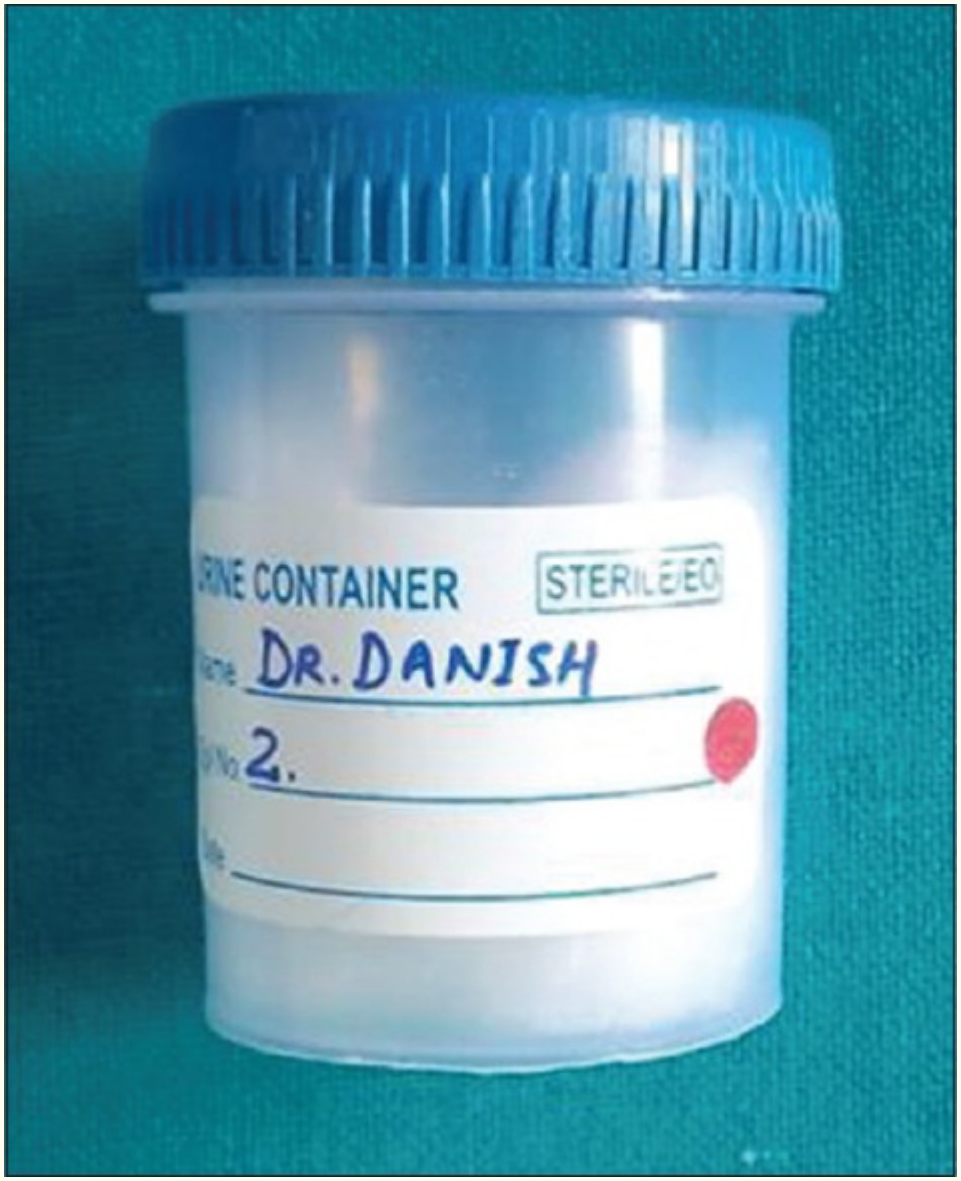

Figure 4

Postrinse saliva sample bottle with red dot

Step 3: Analysis of saliva sample:

For bacterial culture: Aerobic bacterial culture was done by plating the sample directly from the swab on the surface of following culture Medias. Blood agar was incubated at 37°C in 5% CO_2(candle jar) for 24 h. Mac Conkey agar was incubated at 37°C for 24 h in ambient air. Reading was obtained after 24 h by counting of colony.

Step 4: pH was measured using pH strips.

RESULT

Result show that salivary pH increased significantly post - SB rinse [Figure 5]. This increase in pH is statistically significant and sufficient in restricting enamel demineralization. Number of CFU/ml of saliva also decreased for bacteria especially viridans streptococci, *Moraxella* spps, but this decrease was not statistically significant. Moreover, the substantivity of SB in the oral environment remains to be explored

[Tables 1 and 2].

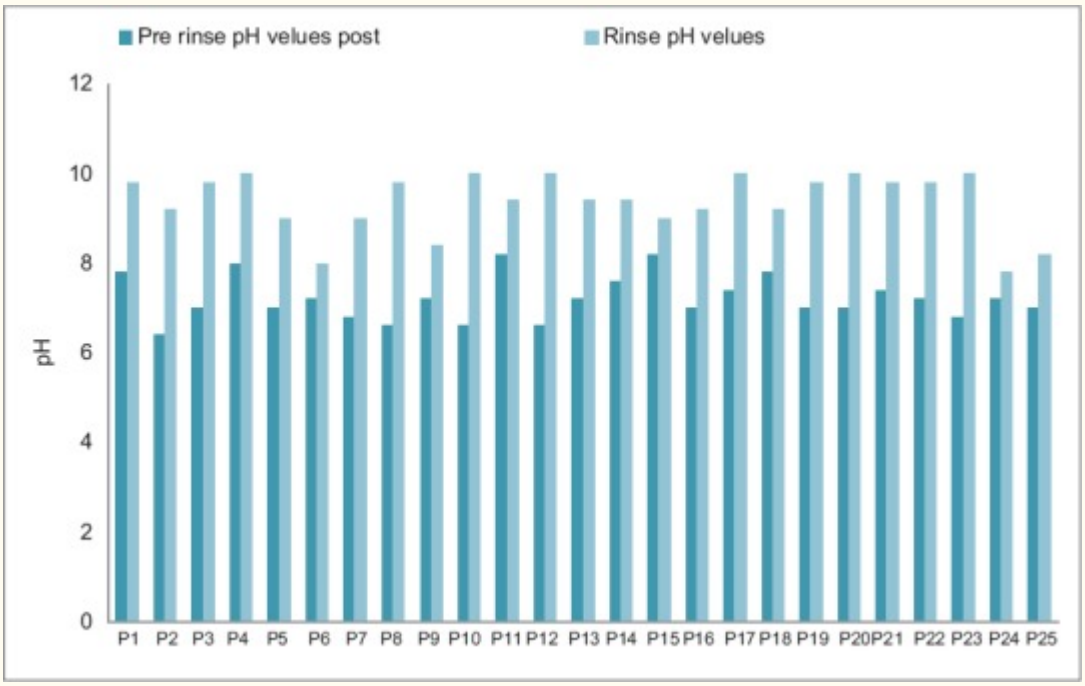

Figure 5

Graphical representation of pre- and post-rinse pH values

Table 1

No of CFU/ml pre and post SB rinse

	Prerinse pH	Prerinse culture ($\times 10^4$)	Postrinse pH	Postrinse culture ($\times 10^4$)
n	25	25	25	25
Mean deviation	7.208	43.11	9.360	10.25
SD	0.4949	76.981	0.6658	10.721

SD: Standard deviation

Table 2

Paired sample T test

	Paired differences					t	df	Significant (two-tailed)
	Mean	SD	SEM	95% CI of the difference				
				Lower	Upper			
Pair 1								
Prerinse pH - postrinse pH	−2.1520	0.8491	0.1698	−2.5025	−1.8015	−12.673	24	<0.001
Pair 2								
Prerinse culture ($\times 10^4$) - postrinse culture ($\times 10^4$)	32.862	79.086	15.817	0.217	65.508	2.078	24	0.049

CI: Confidence interval, SD: Standard deviation, SEM: Standard error of mean

DISCUSSION

It is well established by various studies in literature that high sugar content in diet can result in increased acid production especially lactic acid which results in acidic environment which in turn promotes increase caries activity. High incidence of caries activity was proved in Vipeholm study where he showed that high frequency of sugar intake or diet rich in easily fermentable sugar can result in increased caries activity.[2] Similarly, Walsh conducted a study which confirmed that incidence of dental caries can be decreased by restricting sugar intake in between meals.[3]

In normal conditions acids produced by acidogenic bacteria, for example, *Streptococcus mutans* is buffered by salivary bicarbonate ions, organic acids, peptides, and proteins. It is only when acid produced by acidogenic bacteria increases beyond the buffering capacity of saliva, dissolution of enamel and dentin takes place initiating carious process. Based on this property, an experiment was conducted by Shellis and Dibdin where it was shown that SB incorporated in mouth rinses can increase the buffering capacity of saliva and can buffer acids produced in plaque effectively, resulting in a reduction of acidic environment.[4]

Marco *et al*. incorporated SB along with xylitol and excipients in a mucoadhesive spray, which was further applied on oral mucosa. He tried to evaluate that whether sodium bi carbonate in this form can counteract the drop in salivary pH after a glucose rinse and can, in turn, support the buffering capacity of saliva. This study opened doors for a new approach which could help in counteracting salivary pH drop after a glucose rinse, simply by enhancing or supporting inherent salivary buffering capacity.[5] The product tested in Marco *et al*. study significantly increased the salivary pH taking it above the threshold values needed for dental enamel demineralization. Moreover, this study gave a new approach where it was concluded that supporting the buffering capacity of saliva can help in the prevention of caries, dental erosions and treatment of xerostomia and dental hypersensitivity.

Based on these evidence, the present study was designed to check the effect of sodium bicarbonate rinse in altering the bacterial count and salivary pH in patients. This study showed that role of SB rinse was limited on reducing bacterial count postrinse. It was seen that though for bacteria, no of CFU/ml decreased postrinse this decrease was not statistically significant. Moreover, the substantivity of SB rinse still has to be explored. On the other hand, affect of SB rinse on salivary pH was significant. SB, when used in the form of oral rinse, was successful in increasing salivary pH above the threshold level and thus aided in the prevention of enamel demineralization. Studies also support that in addition to its role in

increasing the salivary pH, SB can also play a role in changing or decreasing the virulence of bacteria that play a pivotal role in causing caries.[6] Animal studies have shown that dentifrices containing SB reduce the amount of both *Streptococcus sobrinus* and *S. mutans*, and this may reduce caries.[7]

CONCLUSION

From this study, we can conclude that SB mouth rinse is effective in increasing salivary pH above the threshold level needed for prevention of enamel demineralization and enhancing remineralization. This positive finding concluded from our study definitely indicates that SB rinse which is low in cost, bland in taste and associated with no side effect can be used as an adjunct to oral hygiene measures for long periods with more patient comfort during the maintenance phase. This oral rinse can have better acceptance in patients with mouth ulcers, a patient undergoing chemotherapy because of its bland taste. Moreover, patients from very remote places where the availability of modern mouthwashes are limited and cost plays an important determinant in their usage; SB mouth rinse can be an effective tool.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Stephen RM. Changes in hydrogen ion concentration on tooth surface and in carious lesions. *J Am Dent Assoc.* 1940;27:718–23. [Google Scholar]

2. Krasse B. The vipeholm dental caries study: Recollections and reflections 50 years later. *J Dent Res.* 2001;80:1785–8. [PubMed] [Google Scholar]

3. Walsh LJ. Fifteen strategies for caries prevention: Towards target zero. *ADA News Bull.* 2000B;;278:17–20. [Google Scholar]

4. Shellis RP, Dibdin GH. Analysis of the buffering systems in dental plaque. *J Dent Res.* 1988;67:438–46. [PubMed] [Google Scholar]

5. Marco G, Giada Colangelo A, Levrini L. 2013;9 Available from: http://www.ariesdue.IT. [Google Scholar]

6. Choi SE, Kim HS. Sodium bicarbonate solution versus chlorhexidine mouthwash in oral care of acute leukemia patients undergoing induction chemotherapy: A randomized controlled trial. *Asian Nurs Res (Korean Soc Nurs Sci)* 2012;6:60–6. [PubMed] [Google Scholar]

7. Legier-Vargas K, Mundorff-Shrestha SA, Featherstone JD, Gwinner LM. Effects of sodium bicarbonate dentifrices on the levels of cariogenic bacteria in human saliva. *Caries Res.* 1995;29:143–7. [PubMed] [Google Scholar]