Original Article

J Nepal Health Res Counc 2015 May - Aug;13(30): 133-7

Comparative Evaluation of Effect of Chlorhexidine and Sodium Fluoride Mouthwashes on Plaque

Sundas S,[1] Rao A[2]

[1]Department of Pedodontics, People's Dental College & Hospital, Kathmandu, Nepal, [2]Department of Pedodontics and Preventive Dentistry, Manipal College of Dental Sciences, Mangalore, India.

ABSTRACT

Background: Dental plaque, deposition of microorganisms embedded in extracellular matrix, initiates dental caries and periodontal diseases. Thus, removal of dental plaque by mechanical or chemical means is the key intervention in prevention of dental caries and gingivitis.

Methods: To compare the efficacy of chlorhexidine (0.2%) and sodium fluoride (0.05%) mouthwashes in reduction of plaque deposition, 75 children of age group 8-14 years were divided in three equal groups. Group A and group B were test groups for chlorhexidine and sodium fluoride respectively and group C was control group. The subjects were instructed to rinse the mouth with 10 ml of mouthwash for one minute twice daily for fifteen days. Amount of plaque was analyzed by Silness and Loe index at the beginning and end of the study period. Inter group and intra group comparisons were done to evaluate the efficacy of mouthwashes by using paired t test and Anova test.

Results: There was significant reduction in plaque in both test groups (p= 0.000) whereas in control group, there was no significant reduction in amount of plaque (p=0.100) count. Efficacy of the both mouthwashes was statistically equal.

Conclusions: Sodium fluoride is as potent antimicrobial agent as chlorhexidine and would be better mouthwash due to its additional remineralization property for prevention of dental caries and gingivitis in children.

Keywords: Chlorhexidine; dental caries; gingivitis; plaque; sodium fluoride.

INTRODUCTION

Dental plaque is a deposition that comprised of numerous living species of microorganisms, embedded in an extracellular matrix. It undergoes growth and maturation with the passage of time by cumulative additions of gram negative, anaerobic and filamentous microorganisms. The central role played by these bacteria is initiation of dental caries and periodontal diseases[1] is well established and removal of plaque is therefore most important means in the prevention of dental caries and gingivitis. Mechanical plaque control by a toothbrush is the most dependable oral hygiene measure. Factors that limit the effectiveness of tooth brushing are lack of dexterity and individual motivation.[2]

Many chemical antiplaque agents in the form of varnishes, dentifrices and mouthwashes have been tried for improvement of oral health. Mouthwashes have been found to be one of the safe and effective delivery systems as anti-microbial and antiplaque agent. These mouthwashes are capable of inhibiting bacterial adhesion, colonization and metabolic activity which ultimately affects bacterial growth and plaque growth. A variety of mouthwashes have been examined for ability to control micro-organisms and to affect the plaque formation.

Among the various mouthwashes, the most persistent reduction of bacteria has been achieved by chlorhexidine mouthwashes.[3] Chlorhexidine gluconate, a cataionoc bisguanide, has a broad spectrum antibacterial effect by

Correspondence: Dr Sunanda Sundas, People's Dental College & Hospital, Kathmandu, Nepal; email: sunandapedo@yahoo.com

virtue of its bactericidal and bacteristatic activity and its high intraoral substantivity. Chlorhexidine though not toxic, has unpleasant taste and it alters the taste sensation.[4] It also produces brown staining of teeth and affects mucous membrane and tongue.[4] This may be related to precipitation of chromogenic dietary factors on tooth surface.[5]

Fluoride in the form of sodium fluoride mouthwash is commonly used in children. Its pH is neutral and is found to be well accepted by the children.[6] It is available in concentration of 0.05% (220ppm) for daily use and 0.2% (900ppm) for weekly use. This mouthwash is recognized as a potent anti-cariogenic agent and is effective in reduction of caries. The anti- caries effect of fluoride on tooth through its remineralization property has been studied and discussed extensively but the effect of fluoride on plaque has taken a backseat. Some recently done studies demonstrated that fluoride mouthwash has potential antimicrobial activities.

The aim of the study was to assess and compare the effect of chlorhexidine and sodium fluoride mouthwashes in reduction of plaque in children.

METHODS

This study was undertaken in the Department of Pedodontics and Preventive Dentistry, Manipal College of Dental Sciences, Mangalore, India in co-ordination with Department of Microbiology, Kasturba Medical College, Mangalore, India. The designed double-blind study was approved by the Ethical Committee, Kasturba Medical College, Mangalore, India. Children with high caries-risk age group, 8-14 (mean age group-12) were recruited from an orphanage in Mangalore. Children with positive medical history, prolonged antibiotic therapy and subjects undergoing orthodontic treatment or with intraoral appliance were excluded. Written consent was obtained from the authorities of the orphanage after the nature of the study and the possible risks were fully explained. Total sample size was 75. Children were randomly divided in three groups as follows:

Group A (n=25) – were given 10ml of 0.2% chlorhexidine gluconate mouthwash (Clohex, DR. Reddy's) twice daily in the interval of 12 hours for 15 days.

Group B (n=25) – were given 10ml of 0.05% sodium fluoride mouthwash (S-Flo, DR. Reddy's) twice daily in the interval of 12 hours for 15 days.

Group C (n=25) – were used as control group.

The subjects were provided non-fluoridated toothpaste (Dabur Red, Hindustan Limited) and were told to brush their teeth twice daily, once in the morning and once in the evening. Hence, the action of fluoride on plaque and bacteria from other sources was not possible and the antimicrobial action of mouthwashes was evaluated without any interference.

Clinical assessments were performed in the clinic by a single examiner using mouth mirror and probe. Dental prophylaxis was not performed so that the study could begin with normal, existing level of plaque deposits of the subjects. Prior to the examination, the children were asked to rinse the mouth with water in order to remove the food debris.

At the beginning of the study, dental plaque was scored by a single examiner on individual plaque assessment forms. Separate plaque assessment form was used for each examination and at no time neither the examiner nor the monitor aware of the group assigned of any subjects. The plaque index described by Silness and Loe (1964) was used to assess the existing dental plaque in children. The full mouth survey was done. The primary counterparts were used in case of unerupted permanent teeth. After initial examination, the subjects were instructed to rinse the mouth with 10 ml of specific mouthwash for one minute twice daily for fifteen days. One doctor was allotted to deliver the mouthwash to the children. A plastic measuring cup was used to measure 10ml of mouthwash and it was given in a disposable glass. The supervision was done by same person while children were taking mouthwash and instruction was given not to rinse the mouth for half an hour. Final data was recorded for amount of plaque present by using same Silness and Loe method at the end of 15 days. The collected data was subjected to statistical analysis. For intra-group and inter group comparison of plaque, Paired t-test and One way Anova test were applied.

RESULTS

Comparison of differences of amount of plaque before intervention and after was done with paired t-test. Table 1 shows amount of plaque before and after intervention in group A (chlorhexidine), group B (Sodium fluoride) and group C (Control Group).

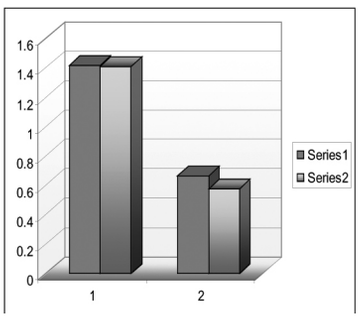
Intergroup comparison was performed between group A and group B to compare the efficacy of chlorhexidine mouthwash and sodium fluoride by using one way Anova test, which showed that there was no significant difference in amount of plaque between two experimental groups before and after the interventions (Table 2 and figure 1).

Table 1. Amount of plaque before and after the interventions.

Group	Plaque status	Mean	Number	Std. deviation	Std. Error mean	P value
A	Amount of plaque before intervention	1.40812	25	0.635700	0.12740	.000
	Amount of plaque after intervention	02.57332	25	0.489479	0.097896	
B	Amount of plaque before intervention	1.41624	25	0.651063	0.130213	.000
	Amount of plaque after intervention	0.66192	25	0.424927	0.084985	
C	Amount of plaque before intervention	1.18436	25	0.526629	0.105326	.005
	Amount of plaque after intervention	0.95692	25	0.492214	0.098443	

Table 2. Amount of plaque between two experimental groups before and after the interventions.

		Df	Mean square	F	P value
Amount of plaque before intervention	Between groups Within groups total	1 48 49	0.001 0-414	0.002	0.965
Amount of plaque after intervention	Between groups Within groups total	1 48 49	0-098 0-210	0.489	0.489



Caption

1- Before,

2-after

Series 1- Sodium fluoride

Series2 -Chlorhexidine

Figure 1. Comparison between Chlorhexidine and Sodium fluoride regarding amount of plaque.

Hence, in the experimental groups (group A using chlorhexidine mouthwash and group B using sodium fluoride mouthwash), plaque at the end of the study were significantly lower than the scores recorded at the baseline. In the control group (group C, no mouthwash), at the end of the study period, there was reduction in amount of plaque but less than that of test groups. At the end 15 days, almost comparable reduction in amount of plaque was found in group A and B. The differences in efficacy of these two mouthwashes were non- significant.

DISCUSSION

Maintenance of a good oral hygiene is the key to the prevention of dental diseases. A review of global data on plaque control revealed that children aged 13-14 years, an average Plaque score of 0.2-0.8 was prevalent and usually this plaque associated diseases could be restored to normal health through adequate plaque control.[7] Therefore, all prophylactic measures are mainly aimed at reduction of plaque.

Amongst all the mouthwashes, chlorhexidine is considered to be the "gold standard" antiplaque mouthwash due to its prolonged broad spectrum antimicrobial and plaque inhibitory potential.[3] It is active against a wide range of gram positive and gram negative organisms, fungi, facultative anaerobes and aerobes.[6] Gram positive cocci especially Streptococcus *mutans* seems to be sensitive to chlorhexidine which acts by binding to bacterial cell wall and affects its function.[8,9] In the present study,

the children who used 0.2% chlorhexidine mouthwash showed significant reduction in amount of plaque at the end of 15 days.

Complete inhibition of bacterial accumulation by chlorhexidine mouthwash has been reported by Schiott.[10] The reduction in amount of plaque found to be statistically significant (p value= 0.000) well corroborates with the results obtained in the previous studies carried out by Loe[11] and Lang et al.[12] Sharma U also found significant amount of plaque reduction in the children who used 0.2%chlorhexidine mouthwash.[13]

Sodium fluoride is the most commonly used mouthwash in children for the prevention of dental caries. Earlier studies have reported that long term use (2-4 year) of 0.2% sodium fluoride resulted lower DMFT index.[14,15] They found that DMFT index was 20.4% lower in children who rinsed the mouth with sodium fluoride. The caries preventive action of fluoride is reported to be due to its effects on the teeth, bacteria and plaque. Fluoride alters the physiochemical properties of teeth by making them more resistant to acid dissolution due to the formation of fluorapatite or fluorhydroxyapatite.[16] It increases the post eruptive maturation, enhances remineralisation and inhibits demineralization. It also has antimicrobial action on dental plaque. Fluoride affects the potential cariogenicity of plaque in many ways. It will reduce acid production and lead to eliminate sensitive bacterial population. It also interferes with the formation of cellular polysaccharide that is required for adhesion. It has been known for a long time that fluoride inhibits glycolytic enzyme enolase which could directly reduce acid production.[17] Inhibition of enolase causes depletion of phosphenolpyruvate that would reduce sugar transport which would, in turn, reduce acid reduction and glycogen synthesis. Reduced glycogen synthesis would adversely affect the ability of bacteria to survive and ultimately reduce bacterial population in the plaque.[18] Laboratory and animal data have shown that fluoride when applied topically inhibit bacterial multiplication, prevent the accumulation of plaque and thus reducing existing plaque.[19]

The result of this study demonstrated that amount of plaque reduced in 15 days on twice daily use of 0.05% sodium fluoride mouthwash. This reduction is statistically highly significant. *P* values in case of plaque reduction was 0.000 indicating that fluoride mouthwash is potent antimicrobial agent. A previous study, semi-quantitatively measuring salivary Streptococcus *mutans* using Dentocult S. M. Kit, reported that children using fluoride mouthwash had a significantly lower level of salivary Streptococcus *mutans* than those using no particular preventive measures.[20] Similar study carried out by Yoshihara and Noboru[21] to evaluate long term use (2years) of sodium fluoride mouthwash on salivary level of Streptococcus *mutans* in school children of age 9-10 year old revealed that children who used fluoride mouthwash had significant lower level of salivary Streptococcus *mutans*. Similarly, Kulkarni and Damle[22], Sharma U[13] and S.E. Jabbarifar[23] also found significant reduction of Streptococcus *mutans* and plaque with sodium fluoride mouthwash.

When comparison was done between chlorhexidine and sodium fluoride mouthwashes, no statistically significant difference was found regarding their antiplaque activities. Kulkarni and Damle[22] reported that sodium fluoride had reduced Streptococcus *mutans* count significantly but was less effective than chlorhexidine. More reduction in plaque was found by 0.2% chlorhexidine mouthwash than 0.2% sodium fluoride mouthwash in the study done by Sharma U (2004).[13] However, in this present study, though no statistically significant difference was found between these two mouthwashes.

CONCLUSIONS

Mechanical oral hygiene practice aids in the removal of accumulated plaque, whereas the chemical agents prevent or reduce plaque accumulation as well as Streptococcus *mutans*. Chemical agents thus, can be used as adjunct to mechanical cleansing for effective oral hygiene maintenance. To conclude the results of present study, sodium fluoride mouthwash would be a better mouthwash due to antimicrobial property besides its additional remineralization ability since chlorhexidine is not preferred by children due to its bitter taste.

REFERENCES

1. Carranza FA. Glickman's Clinical Periodontology. 7th Asian ed., WB Saunders Company. Philadelphia.1990;684-711.
2. Binney A, Addy M, Robert G. The plaque removal effects of single rinsings and brushings. J Periodontal.1993;64(3):181-5.
3. American Dental Association's Council on Dental Therapeutic Guidelines for acceptance of chemotherapeutic product for control of supragingival dental plaque and gingivitis. Journal of American Dental Association.1986;11(2):529-32.
4. Flotra L, Gjemo P, Rolla G, Waerhaug J. Side effects on chlorhexidine mouthwashes: European Journal of Oral Sciences.1971; 79(2):119-125.
5. Zanela NLM, Bijella MFTB, Rosa OPS. The influence of mouthrinses with antimicrobial solutions on the inhibition of dental plaque and on the levels of mutans streptococci in children. Pesqui Odontol. Bra.2002;16(2):101-6.

6. Chikte UM, Lewis HA, Rudolph M J. The effectiveness of a school based fluoride mouth rinse programme. J Dent Assoc S Afr. 1996;51(11):697-700.
7. Guteress TW. Periodontal health and periodontal diseases in young people: global epidiomology Int Dent J. 1986;36(3):146-51.
8. Henssey TD. Antibacterial properties of hibitane. J. of Clin Periodontl.1977(extra issue);4(5):36-48.
9. Emilson CG. Susceptibility of various micro-organisms to chlorhexidine. European Journal of Oral Sciences.1977; 85(4):255-265.
10. Schiott CR. Effect of chlorhexidine on microflora of oral cavity. J Periodon. Res.1973; 8(S12):7-10.
11. Loe H, Schiott CR. The effect of mouthrinses and topical application of chlorhexidine on the development of dental plaque and gingivitis in man. J of Periodont. Res.1970; 5(2):79-83.
12. Lang NP, Catalantto FA, Knopfi RU. Quality specific taste impairment following the application of chlorhexidine mouthrinses. J Clin. Periodontal. 1988;15(1):43-8.
13. Sharma U, Jain R L, Pathak A. A clinical assessment of the effectiveness of mouthwashes comparison to tooth brushing in children. J Indian Soc Pedo. Prev. Dent June.2004;22 (2):38-44.
14. Leske GS, Ripa LS, Sposato AL, Koulourides TI. Posttreatment benefits from Participating in A School-Based Fluoride Mouthrinsing Program. J of Public health Dent.1981; 41:103-8.
15. Leske GS, Ripa LW, Sposato A. Post treatment benefits in a school based fluoride mouthrinsing program: Final results after 7 years of rinsing by all participants. Clin. Prev. Dent.1986; 8(5):19-23.
16. Featherstone JDB. Prevention and reversal of dental caries: role of low level fluoride. Community Dent Oral Epidemio.1999; 27(1):31-40.
17. Hamilton IR. Biochemical effects of fluoride on oral bacteria. J Dent. Res.1990;69:660.
18. Bradshaw DJ. Marsh PD, Hodgeson RJ. Visser JM. Effects of glucose and fluoride on competition and metabolism within in vitro dental bacterial communities and biofilm. Caries Res.2002; 36(2):81-6.
19. Grant DA, Stern IB, Everett FG, Orban BJ. Periodontics in the Tradition of Orban and Goltteib. 5th edition, Mosby.1979; 130-51.
20. Yoshihara A, Sakuma S, Kobayashi S, Miyazaki H. Antimicrobial effect of fluoride mouthrinse on mutans streptococci and lactobacilli in saliva. Pediatric dentistry.2001; 23(2), 113-17.
21. Kaneko N, Yoshihara A, Ida H, Nomura Y, Imai S, Nisizawa T et al. Influence of a fluoride mouthrinse on mutans streptococci in schoolchildren. Caries Res.2006;40(6):501-7.
22. Kulkarni VV, Damle SG. Comparative evaluation of efficacy of sodium fluoride, chlorhexidine and triclosan mouth rinses in reducing mutans streptococci in saliva: an in vivo study. J Indian Soc. Pedo. Prev. Dent. 2003; 21(3):98-104.
23. Jabbarifar SE, Tabibian SA, Poursina F. Effect of fluoride mouth rinse and tooth paste on number of streptococcal colony forming units of dental plaque J. of Research in Medical Sciences.2005;10(6):363-67.