

THE EFFECT OF DENTIFRICE CONTAINING 1%CHLORAMINE-T AND TRICLOSAN ON PLAQUE AND GINGIVAL STATUS: AN IN-VIVO COMPARATIVE STUDY

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ABSTRACT

PURPOSE: Chloramine-T has been used in disinfecting impression material, dental appliances and in a dentifrice for total denture cleaning. Owing to the established causal role of bacterial plaque in gingivitis and the effectiveness of dentifrice in plaque control in addition to the toothbrush, it is appropriate to consider the role of Chloramine T in plaque control and compare it with commercially available triclosan containing dentifrice.

Materials and Methods: A clinical, randomized, double-blind comparative study was conducted on 60 volunteers above 18 years belonging to the Sumandeep Vidyapeeth. Dentifrice containing 1% Chloramine T and a commercially available Triclosan containing dentifrice (Colgate Triple Action) were used in the study. The study subjects were divided into group Group I and Group II and were given dentifrice containing 1% Chloramine-T(experimental) and Triclosan (commercially available) respectively. Among the 60 volunteers the dentifrices were provided in identical, color coded tubes, and were instructed to use the dentifrices three times a day for the duration of 7 days. **Results:** Highly significant results were obtained after the intervention of commercially available Triclosan in case of plaque ($p=0.000$) and gingival status ($p=0.001$). Similar statistically significant results were obtained from Experimental dentifrice (1%Chloramine-T) for Plaque ($p=0.001$) and Gingivitis score ($p=0.024$). **Conclusion:** Chloramine-T and Triclosan had almost similar effect on gingival status and plaque. Chloramine-T can be used

as an economical and affordable dentifrice at the community level.

KEYWORDS: Chloramine-T; triclosan; double blind; in vivo

INTRODUCTION

Maintaining good oral hygiene is essential to prevent the oral cavity from various dental problems such as dental caries, plaque and gingivitis.^[1] Meticulous plaque removal on a daily basis is important to prevent caries, gingival and periodontal disease.^[2] Gingivitis is a reversible disease and its primary etiology is bacterial plaque, which can initiate destruction of the gingival tissues and periodontal attachment apparatus. Appropriate supportive periodontal maintenance that includes personal and professional care is important in preventing re-initiation of inflammation.^[3] The classic experiments by Loe *et al.*, and Theilade *et al.*, showed a clear relationship between plaque accumulation, maturation and onset of gingivitis.^[4] Effective plaque control facilitates good gingival and periodontal health, prevents tooth decay and preserves oral health for lifetime. Though there are various methods including chemical and other mechanical methods for plaque removal but tooth brushing is the widely accepted and primary method of removing plaque.^[5] In order to achieve efficiency by mechanical methods only, individual motivation and high standards of skill are required.^[6] Moreover problems like frequency, duration, and consistency of tooth brushing, might interfere in achieving effective plaque control.^[5] Furthermore, the effectiveness of plaque removal is dependent on factors such as dexterity and compliance of the individuals.^[7] Chemotherapeutic agents have the potential to inhibit plaque growth, reduce

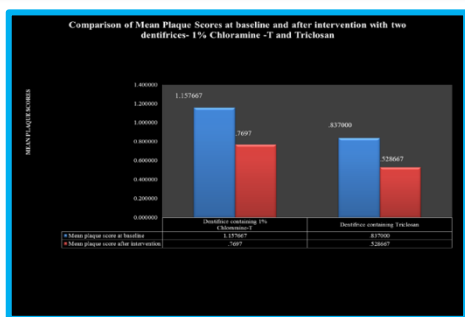


Fig. 1: comparison of mean plaque score of the two groups at Baseline and after 7 days intervention of the given dentifrices

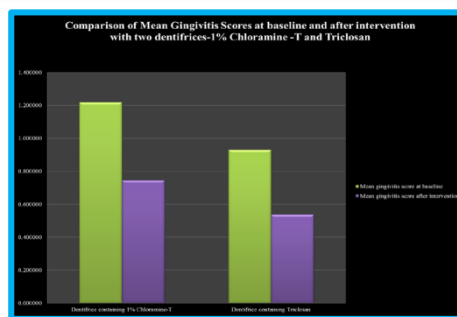


Fig. 2: comparison of mean gingivitis score of the two groups at Baseline and after 7 days intervention of the given dentifrices

Table 1: Comparison of Mean Plaque scores after using two different dentifrice containing-- 1%Chloramine-T and Triclosan using paired t-test

Statistical Procedure	Mean plaque score at baseline and after using dentifrice containing 1%Chloramine-T	Mean plaque score at baseline and after intervention of group using Triclosan
Mean±standard deviation	0.388± 0.237	0.3083±0.2010
t-value	8.966	8.399
p-value	0.001	0.000
Statistical significance	Significant	Highly Significant

Table 2: Comparison of Mean Gingivitis scores after using two different dentifrice containing-- 1%Chloramine-T and Triclosan using paired t-test

Statistical Procedure	Mean Gingivitis score at baseline and after using dentifrice containing 1%Chloramine-T	Mean Gingivitis score at baseline and after intervention of group using Triclosan
Mean±standard deviation	0.473±0.287	0.3936±0.244
t-value	9.020	8.813
p-value	0.024	0.001
Statistical significance	Significant	Highly Significant

gingivitis and improve oral health beyond tooth brushing alone.^[6] In 1985 the Council on Dental Therapeutics of the American Dental Association (ADA) established guidelines for the acceptance of anti-plaque/gingivitis agents. According to these guidelines a chemical agent such as Stannous Fluoride, Chlorhexidine, cetylpyridinium chloride (CPC) could prevent or reverse gingivitis if it: (a) eliminates all plaque; or (b) reduces plaque below an individual’s threshold for disease; or (iii) alters the bacteria of plaque in such a way that health would not convert to disease.^[4] Chloramine - T is well known for its effectiveness against bacteria, viruses and spores. It is widely used for disinfection and as an algicide, bactericide, germicide for parasite control, and for drinking

water disinfection. It has also been used in disinfecting impression material, plaster models, dental appliances, acrylic prosthesis and also as a surface disinfectant.^[8] It contains active (electrophilic) chlorine in the form of NaClO and HClO.^[9] Its mechanisms of action are oxidative reactions and protein hydrolysis. The oxidative reactions and protein hydrolysis kill gram positive and gram negative bacteria, fungi, viruses, mycobacteria and yeast in both aerobic and anaerobic environments quickly, even at low concentrations.^[10] Owing to the established causal role of bacterial plaque in gingivitis and the effectiveness of dentifrice in plaque control in addition to the toothbrush, it is appropriate to consider the role of Chloramine T in plaque control.^[11] Hence the present study was conducted

with the aim to clinically compare the effectiveness against plaque and gingival status of dentifrice containing 1% Chloramine T with commercially available dentifrice containing Triclosan.

OBJECTIVES

1. To evaluate the oral hygiene status using Plaque index (Silness&loe) at baseline and after seven days post brushing with experimental dentifrice containing 1% Chloramine T and commercially available dentifrice containing Triclosan.
2. To evaluate the gingival status using Gingival index (Loe and Silness) at baseline and after seven days post brushing with experimental dentifrice containing 1% Chloramine T and commercially available dentifrice containing Triclosan.

MATERIAL AND METHODS

An experimental, randomized, double-blind comparative study was conducted on student volunteers above 18 years belonging to Sumandeep Vidyapeeth in Department of Public Health Dentistry at KM Shah Dental College. The study protocol was reviewed and approved by the research cell of K. M. Shah Dental College and Hospital i.e. Human Research Review Board and ethical approval was obtained by the Ethics committee, Sumandeep Vidyapeeth, Piparia, Vadodara. Chloramine- T was obtained from a certified laboratory in Vadodara, Gujarat with a bioassay of 99.9%. The dentifrice was prepared under the guidance of the Principal, College of Pharmacy, Sumandeep Vidyapeeth. Commercially available dentifrice containing Triclosan (Colgate Triple Action) was obtained from a retail store. The sample size for the study was 60 which was estimated using $m/1+ (m-1/N)$ where N= Population from which sample is to be chosen and m= sample size necessary for estimating the proportion for a large population.^[12] The inclusion criteria for the study were subjects above 18 years of age, plaque and gingivitis score > 0, apparently healthy periodontium with a probing depth of not more than 3mm, presence of all index teeth required for recording Plaque index and Gingival index and no statistical significant difference between the scores of the subjects at the baseline of plaque and gingival index. The exclusion criteria defined for the study were subjects suffering from

systemic diseases, allergic to Triclosan and Chloramine-T, subjects using any adjunct oral hygiene aid, subjects undergoing orthodontic or prosthetic treatment and subjects who had undergone oral prophylaxis within 21 days. The samples who matched the above criteria were divided into two groups with 30 subjects each. The identity of the dentifrices was not revealed to the patients or to the examiner clinician assessing PI and GI. Each group was provided with one of the evaluated dentifrices. The experimental dentifrice was formulated and inserted into an opaque, different color coded tubes. Only one lay person was aware regarding the information pertaining to which tubes contained which dentifrices. The study subjects were instructed to brush their teeth three times a day for seven days.^[13] The subjects were instructed to brush, using dentifrice along the length of toothbrush head for 2-3 minutes. To ensure compliance with the proper brushing technique, one day session was undertaken by the clinician and pamphlets depicting the pictorial representation of modified bass technique were given to the subjects. The subjects were instructed not to use any other oral hygiene aid during the study period. Plaque and gingivitis was recorded using Plaque index (Silness & loe)^[14] and gingival index (Loe and Silness)^[15] at baseline and after using the given dentifrice of triclosan and chloramine-T respectively for 7 days.

STATISTICAL METHOD

The data was compiled and was entered into Microsoft excel sheet and then was analyzed using SPSS 20.0 version for windows. Means and Standard Deviations were calculated using descriptive statistics and comparison among the intervention group were done using Paired t-test.

RESULTS

Among the Study groups, Group I was given dentifrice containing 1%Chloramine-T, Group II was given commercially available dentifrice containing Triclosan. Fig. 1 and Fig. 2 shows the mean plaque and gingival index score among the two groups at base line and after intervention. As shown in Table 1, the mean plaque score at baseline and after intervention with dentifrice containing 1% Chloramine-T was 0.388 ± 0.237 while the mean plaque score at baseline and after intervention with Triclosan was 0.3083 ± 0.2010 . Change in plaque score after intervention with

dentifrice containing 1% Chloramine-T and Triclosan was found to be significant ($p=0.001$) and ($p=0.000$) respectively. Table 2 shows the mean gingivitis score at baseline and after intervention with 1% Chloramine-T was 0.473 ± 0.287 whereas the mean gingivitis score at baseline and after intervention with Triclosan was 0.3936 ± 0.244 . Comparison of gingival score after using 1% Chloramine-T and Triclosan containing dentifrice was ($p=0.024$) and ($p=0.001$) respectively. From Table 1 and Table 2, it can be noted that the change in gingivitis and plaque score from baseline to 7 days after using 1% Chloramine-T and Triclosan was significant in both the groups. But after using the dentifrice containing 1% Chloramine-T for 7 days, the reduction in mean plaque and gingival score is less than that with Triclosan.

DISCUSSION

Various methods of plaque control have been the cornerstone for prevention of gingival and periodontal disease. However, widespread prevalence of gingivitis throughout the globe proves this in the opposite direction. This may be due to inefficiency of self-performed mechanical plaque control devices; hence the need and importance of chemotherapeutic agents increases for control and prevention of gingival and periodontal disease. Formulations containing chlorhexidine, mouthrinses containing essential oils and triclosan/copolymer dentifrices have well documented clinical antiplaque and antigingivitis.^[16] This justifies the use of chemical anti-microbials in the dentifrices formulations. Based on these facts new proposals for various dentifrices formulations to control and prevent various gingival and periodontal diseases, caries have been proposed. Olympio *et al.*, (2006) compared dentifrices with 1100 ppm NaF; experimental 1100 ppm NaF plus 0.95% chlorhexidine and experimental 0.95% chlorhexidine dentifrices in terms of dental plaque, gingivitis, bleeding, calculus and extrinsic enamel staining in volunteers on fixed orthodontic therapy. Chlorhexidine dentifrices significantly increased the mean stain index, and dental calculus was not affected. The products containing chlorhexidine were statistically significantly better for dental plaque, gingivitis and bleeding scores.^[17] Dentifrices containing Aloe vera extract, for example, exhibited lower

efficacy on the control of dental plaque and gingivitis compared with regular fluoride-containing dentifrices (Oliveira *et al.*, 2008).^[18] The present study was conducted to observe whether Chloramine - T, well known for its effectiveness against bacteria, viruses and spores, can be incorporated in the category of chemotherapeutic agents in adjunct to the most commonly used Triclosan. In an effort to improve the effectiveness of plaque control and periodontal health, Triclosan (5-chloro-2-(2,4-dichlorophenoxy) phenol) a broad-spectrum antibacterial agent, has been added to dentifrices.^[11] Fine D H *et al.*, investigated the effect of a triclosan/copolymer dentifrice on the relative distribution of microorganisms in three oral sites (plaque, saliva and the tongue) six hours and 12 hours after use, the results of which demonstrated a statistical significant antimicrobial effect.^[19] In the present study the volunteers who used the dentifrice containing triclosan experienced a significant decrease in dental plaque score and gingivitis score. Chloramine-T was introduced as a disinfectant by Dakin *et al.* (1916), and since then the product has come to be considered safe for human use and is widely employed in various industries.^[20] Pitten and Kramer (1999) used chloramine-T in mouth rinse formulation, and Panzeri *et al.*, (2008) evaluated an experimental dentifrice containing chloramine-T for total denture cleaning on 60 subjects and showed a significant decrease in the amount of total denture biofilm when compared with a control.^[21, 11] Tirapelli C *et al.*, (2010) found that there was no statistically significant difference between the PI and SBI scores after comparing the use of chloramines-T and commercially available triclosan, suggesting that they exerted a similar effect on the oral health indexes.^[10] The effect of chloramine-T as an antimicrobial agents shows a significant reduction in the plaque score and gingivitis score of the subjects in this study. Tirapelli *et al.*, (2010) showed that there is a significant reduction in the PI score after using both chloramine-T dentifrice and gold-standard dentifrice. They also found that both reduced the PI significantly. The significance level at which the triclosan dentifrice decreased PI on lingual surfaces compared to baseline ($P < 0.01$) was greater than that for the chloramine-T dentifrice ($P < 0.05$).^[10] The present

study showed that there is a statistical significant difference in the plaque index score between the two groups ($p=0.000$ in triclosan group and $p=0.001$ in chloramine-t group) and in the gingival index score of the two groups ($p=0.024$ in chloramine-t group and 0.001 in triclosan group).

LIMITATION

The entire study was conducted in a professional university, where the volunteers were naturally exposed to an environment with oral health motivation and information.

RECOMMENDATIONS

1. Further prospective studies in the following direction may throw light upon the effect of dentifrice containing 1% Chloramine T when used for a longer duration.
2. Further prospective studies can be conducted using Chloramine T with higher concentration.
3. In the present study, it has been observed that dentifrice containing 1% Chloramine T has similar effect on plaque and gingivitis as Triclosan, hence it can be further incorporated as an antiplaque and antigingivitis agent in dentifrice formulation.

CONCLUSION

Dentifrice containing Triclosan and Chloramine-T (1%) have significant effect on plaque and gingivitis status among the study subjects. It can be incorporated in the dentifrices formulations.

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CONFLICT OF INTEREST & SOURCE OF FUNDING

The author declares that there is no source of funding and there is no conflict of interest among all authors.

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