Effect of Triclosan and Sodium Monofluorophosphate on Plaque Reduction

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Authors’ contributions
This work was carried out in collaboration among all authors. Authors SS and MAB designed the study, performed the statistical analysis, Author SS wrote the protocol and wrote the first draft of the manuscript. Authors MM and AQKD managed the analyses of the study. Author PM managed the literature searches. All authors read and approved the final manuscript.

ABSTRACT

Objective: The aim of the study is to compare the clinical efficacy between two ingredient Triclosan and sodium monofluorophosphate on plaque accumulation.

Material and Methodology: This cross section study was carried out in school (Govt Girls High School Kotri). Total 100 school children were selected, between age ranges 13–16 years, which were divided in to two groups (group A & B) according to dentifrice given. Group A: Toothpaste containing the active ingredient 0.3% Triclosan. Group B: Toothpaste containing 0.8% sodium monofluorophosphate. All patients were examined clinically for assessment using the Plaque index (PI) at follow up periods every week. Plaque was evaluated by using the Silness-loe index. Oral examination for dental plaque assessment was carried out at the start of the study and the children were follow up to 10 weeks. Data were analyzed by SPSS 16 version and one-way ANOVA test.

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Result: Triclosan toothpaste users experienced significant reduction in plaque accumulation as compared to the sodium monofluorophosphate toothpaste users.

Conclusion: At 3-weeks, Triclosan provided statistically significantly greater reductions than sodium monofluorophosphate in plaque reduction.

Keywords: Plaque reduction; sodium monofluorophosphate; triclosan.

1. INTRODUCTION

Dental plaque is a dynamic microbial biofilm environment. The initiation of dental plaque with devotion of selected bacterial containing streptococcus species, to saliva-bathed surface.

Basically plaque is multilayered growth of microorganisms that contain of primary adhesion of microbes cells which attached on the superficial surface on tooth at the pellicle level. And in the primary phase plaque is weekly attached on the tooth surface for the reason that the adhesion of the plaque to the tooth surface happen by weak van der waals interaction. And primary stage of plaque buildup is reversible, though, if left to accumulate, a solid bond produce among the bacterial plaque and pellicle. This reversible plaque simply detached through at home oral hygiene regimens but mature plaque mostly needs professional mediation. This leads to the rational that a toothpaste that permit for active plaque elimination beforehand it develops irreversible bound to the tooth surface will begin an atmosphere for good oral health [1].

Not maintaining good oral hygiene may develop many harmful activities in oral cavity through the accumulation of microbes. [2-3] The virulence of complex oral micro-communities are main cause of dental plaque, periodontitis and dental caries. Dental plaque has been prove that principal elements for the initiation and progression of other dental diseases like gingivitis, periodontitis [4] Dental plaque present on the healthy gum with its microbial hemostasis, can leading favor diseases by the changes in plaque micro floral mechanism [5] Most common cause of tooth loss due to the periodontal, dental cariesand Dental plaque [6,7].

Dental plaque reacts with an inflammatory response, and main causative factor for the initiation of the periodontitis and dental caries8.Presence of dental plaque for a longer period can lead to dental caries due to chemical dissolution [9-10].

The use of chemical agents which contain antiplaque, anti-microbial activity into dental products has been recommended as a possible prophylactic method of reducing plaque-initiated diseases by preventive the cariogenic bacteria in the oral cavity and also as well cleaning of teeth [11].

Maintaining proper oral hygiene is directly removal of plaque from the tooth surface, are related to the tooth brushing frequency [12].

The dentifrices have been reported to be efficient in reducing dental plaque, gingivitis and slow progression and so on till recurrent periodontitis [13,14].

Broad-spectrum phenolic biocides Triclosan [5-chloro-2-(2,4-dichlorophenoxy)phenol] with activity against both bacteria and fungi. However, toothpaste with triclosan decrease dental plaque and gingival inflammation. Triclosan is compatible with toothpaste component as a low toxicity and non-ionic chlorinated bisphenolsuch as fluoride and surfactant [15].

Triclosan promote inhibition of pathways cyclooxygenase / lipooxygenase by their anti-inflammatory effect [16].

Recently published study reported that after the five years use of triclosan containing toothpaste did not develop triclosan-resistant bacteria [17,18] Therefore purpose behind this study was to evaluate the, comparative effect between two ingredient triclosan and sodium monofluorophosphate on plaque reduction.

2. MATERIALS AND METHODS

This study was conducted at Government girls school Kotri, from 5 march to 25 may 2017. The study design was cross sectional and convenience and non-probability sampling technique.

100 children age range between 14 to 16 years, who satisfied the inclusion and exclusion criteria, participated in this study.

Exclusion criteria were:

1. Children wearing removable and fixed orthodontic appliances.
2. Medically compromised or intellectually disabled patients.
3. Children with mild to severe gingivitis.
4. The use of antibiotic, antimicrobial, analgesic medications, mouthwash or desensitizing toothpaste during the previous 2 months.
5. Individuals who have significant dental disorders (e.g: suspected pulp pathology, abscess, and pulpitis).

**Inclusion Criteria were:**

1. Participants age (age 13 to 16 years),
2. Individuals with plaque, mean full-mouth PI ≥ 0.9 and 1.0 at inclusion
3. Individuals who have at least 20 own teeth excluding the wisdom teeth,

Selected children were divided into two groups (group A and group B).

**Group A:** Toothpaste containing the active ingredient 0.3% Triclosan

**Group B:** Toothpaste containing active ingredient 0.8% sodium monofluorophosphate.

Toothpaste and soft-filament toothbrush were given to selected participants for a 10-week period of home use. Study subjects were given home instructions regarding tooth brushing their teeth for one minute twice daily with the provided toothpaste containing plaque reduction ingredients and toothbrushes, and not to use other oral hygiene products. Proper brushing technique was explained.

The volunteers were re-examined in 2nd, 6th, and 10th weeks. Plaque levels were measured by appropriate scale (Silness-Loe plaque index).

| Silness-LOE Plaque Index | Criteria |
|-------------------------|----------|
| 0                       | Absence of Microbial Plaque |
| 1                       | Thin Film of Microbial Plaque Along the Free Gingival Margin |
| 2                       | Moderate Accumulation with Plaque in the Sulcus |
| 3                       | Large Amount of Plaque in Sulcus or Pocket along the Free Gingival Margin |

2.1 Statistical Analysis

Data was entered in the SPSS version 16 for the analysis. Data collected, was subjected to statistical analysis using repeated-measure analysis of variance (ANOVA) that is one-way ANOVA to see the time related difference between the plaque scores of group A and group B in the beginning of the research and the same was repeated at times of 2nd, 4th, 6th, and 10th weeks during the course of the study Friedman test of one way ANOVA test, and mean, st: deviation were employed while comparisons between the two study groups. P-value less than 0.05 was considered as significant.

Qualitative data was described using number and percent. Quantitative data were described using range (minimum and maximum) mean, standard deviation, median.

3. RESULTS

Total hundred children were studied, 50 in each group. Children's age range was 13 to 16 years; their mean age was 14.34±1.23

Mean plaque score of both groups was statistically insignificant (P=0.573). On 2nd weeks follow-up mean plaque score was 03.99±1.01 in group A and 03.91±1.65 in group B (P=0.643). On 6th weeks mean plaque score showed significant reduction in group A as 02.96±0.88 as compared to group B as 03.01±1.05 (P=0.046). On 10th weeks follow-up plaque average was significantly decreased in group A as 01.05±0.55 in contrast to group B as 02.44±0.64 (P=0.028). Table 2.

4. DISCUSSION

Dental plaque is a widely recognized factor in the initiation and progression of a variety of oral diseases [19] Microbial plaque, which lies in close proximity to gingival tissue, is an important etiological factor instigating gingival inflammation and, in some cases, subsequent loss of the periodontal tissue. In this study mean age was 14.34±1.23 years in group A and 15.94±1.44 year in group B (P=0.734). Consistently Bayoumi M et al. [20] also observed mean age of the patients 11.58 ±1.36 years. In this series males were in majority in both groups as; 58.0% were males in group A and 66.0% males were in group B. On other hand Sangeetha KM et al. [21] also found male children in majority 34 (60.7%) as compared to females 22 (39.3%). However, Bayoumi M et al. [20] inconsistently reported that 37.6% were males and 62.2% were females.
Table 1. Mean age and gender of the both study groups n=100

| Variables      | Study groups          | p-value |
|----------------|-----------------------|---------|
|                | Group A n=50          | Group B n=50 |
| Age (mean±SD)  | 14.34±1.23            | 15.94±1.44 | 0.734 |

Table 2. Mean plaque score according to follow-up in both study groups n=100

| Plaquescore     | Study groups          | p-value |
|-----------------|-----------------------|---------|
|                 | Group A n=50          | Group B n=50 |
| Before treatment| 04.92±1.55            | 04.85±1.92 | 0.573 |
| At 2<sup>nd</sup> weeks follow-up | 03.99±1.01          | 03.91±1.65 | 0.643 |
| At 6<sup>th</sup> weeks follow-up | 02.96±0.88          | 03.01±1.05 | 0.046 |
| At 10<sup>th</sup> weeks follow-up | 01.05±0.55          | 02.44±0.64 | 0.028 |

Dental plaque removal is an important issue in health promotion. Tooth brushing is one of the main methods employed for such a purpose since it can prevent dental caries. In this study we comparatively used Triclosan and sodium monofluorophosphate to reduce the plaque accumulation. In this study we observed that Triclosan was the more effective in the removing of dental plaque in young children. Similarly Kraivaphan P et al. [22] reported that after five months, the triclosan dentifrice significantly reduced plaque formation as after 5 months of treatment mean plaque score was 1.321 ± 0.929 as compared to controls 2.219 ± 0.663. Sangeetha KM et al. [21] also observed that the triclosan containing tooth paste has shown better in reduction of plaque scores when compared to the conventional fluoride containing tooth paste. Bayoumi M et al. [20] also stated that Triclosan toothpaste users experienced significant reduction in plaque accumulation. On the other hand, Bhavesh et al. [23] found that both Triclosan and Chlorhexidine equally inhibited the colonization of Streptococcus mutans on the orthodontic components. Triclosan is known as a broad spectrum antimicrobial activity, it also has well-known of metabolism of fluoride which effect on oral bacterial and inhibit several essential enzymes in oral bacteria as stated by Hamiton et al. [24] Antimicrobial act of triclosan in low concentration it adsorbs to lipid portion of the bacterial cell membrane which obstructs with vital transport mechanism due to its hydrophobic and lipophilic nature. In a mechanism of plaque microorganisms, fluoride is a dominant inhibitor of acid formation that is another chief component which is inhibits the acid formation in plaque mechanism. Fluoride has an assembly of direct and indirect effects on the bacterial cell that current suggestion indicates that’s, which have a significant effect on dental plaque organism. This study have shown that antimicrobial activity of the toothpaste containing 0.3% triclosan and 0.8% sodium monofluorophosphate as an active ingredient, between two ingredient comparative showed a significant difference against plaque accumulation, triclosan containing toothpaste user showed a significant reduction in plaque formation. Further studies required with large sample size and multi centric studies are required on this comparison.

5. CONCLUSIONS
The present cross section study conducted over a 10 weeks of period, confirmed that the dentifrice containing sodium monofluorophosphate and triclosan was effective in inhibiting the accumulation of dental plaque. This study demonstrated the antimicrobial efficacy of toothpastes containing triclosan, sodium MFP against a variety of microorganisms of dental plaque. Further large sample size and multi central studies are required on this comparison.

CONSENT AND ETHICAL APPROVAL
Parent of the selected children sign an inform consent form, after explaining the nature of the study. The necessary approval for the study is taken from the school authorities.

COMPETING INTERESTS
Authors have declared that no competing interests exist.

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