

Comparative Evaluation of Triclosan- Containing Toothpaste and Non -Triclosan - Containing Toothpaste in the Management of Gingivitis Patients

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Abstract:

Background: To evaluate and compare triclosan containing toothpaste and non-triclosan containing toothpaste in the management of gingivitis patients.

Materials and Methods: 48 participants with gingivitis were divided into two groups with 24 participants each. Each participant received ultrasonic scaling. After ultrasonic scaling, group I was asked to use 0.3% triclosan containing tooth paste and group II was asked to use 0.454% stannous fluoride containing tooth paste (non-triclosan). Plaque index (PI), Gingival index (GI), Bleeding index (BI) were recorded at baseline and 4 weeks after using above-mentioned toothpaste

Results: Group I and Group II showed improvement in plaque index and gingival index with reduction in bleeding index scores at 4th week. However, Group I showed statistically significant reduction in plaque index, gingival index and bleeding index scores at 4 weeks compared to Group II.

Conclusion: This study concludes that by adjunctive use of triclosan containing toothpaste gingival health can be restored and bleeding gums and plaque deposition can be reduced.

Key Word: Triclosan toothpaste, Stanous fluoride, Gingivitis , Dental plaque, Plaque control, Gingival Bleeding

Date of Submission: 29-09-2026

Date of Acceptance: 08-10-2026

I. Introduction

Periodontium is composed of gingiva, periodontal ligament, alveolar bone and cementum. They provide adequate support for the teeth to function physiologically.^[1] Gingiva is anatomically divided into marginal gingiva, interdental areas and attached gingiva. Inflammation of marginal gingiva is termed gingivitis. Gingivitis is reversible by proper management. In few individuals gingivitis may progress to periodontitis.^[2] The types of gingivitis most frequently encountered are plaque-associated, acute ulcerative necrotizing, hormonal, and drug-induced or spontaneously occurring hyperplastic gingivitis. Plaque-associated gingivitis is by far the most prevalent, accounting for many more cases than all other forms combined. There is overwhelming evidence that the direct cause of gingivitis is the accumulation of microbial plaque on and near the cervical region of the teeth (Loe et al. 1965, Lindhe et al. 1973, Lindhe & Rylander 1975, Payne et al. 1975, Page & Schroeder 1976, 1982, Moore et al. 1982, 1984, Best et al. 1985). All other suspected local and systemic factors either enhance plaque accumulation or interfere with its removal and control, or enhance the susceptibility of the gingival tissues to the microbial challenge via as yet obscure mechanisms.^[3]

Poor oral hygiene is one of the reasons for accumulation of microbes and their harmful activities. The American Dental Association (ADA) recommends twice daily brushing and once daily flossing as a regimen for good oral hygiene. The success of daily oral care depends on the individual defence mechanism, as well as knowledge, dexterity and discipline. A dentifrice is recommended to support the efficacy of tooth cleaning. Dentifrices are ideal vehicles for the carriage of plaque control agents in common usage. Some of their major ingredients include abrasives, detergents, thickeners, sweeteners, humectants, flavours and actives, such as triclosan and stannous fluorides (SnF) or other fluorides.^[28]

The customary oral hygiene method of chemical plaque control can be used as an adjunct to mechanical plaque control procedure. Besides cleaning of teeth, the use of chemical agents with antiplaque or antimicrobial activity into dental products has been proposed as a potential prophylactic method of reducing plaque-mediated disease by limiting the cariogenic bacteria in the oral cavity.^[5] Recently, a number of chemical agents have been advocated which are available in a toothpastes or dentifrices or in the form of a mouthwash.

Since its first use in European toothpaste in 1985 triclosan a low-toxicity, non-ionic phenolic derivative with a wide spectrum of antimicrobial activity has been the active ingredient in many oral hygiene formulations.^[6]

Triclosan is a broad spectrum antibacterial agent (2, 4, 4'-trichloro-2'-hydroxydiphenyl ether). Triclosan demonstrates efficacy against a variety of Gram-positive and Gram-negative bacteria and is widely used in over-the-counter consumer products including deodorant soap bars, liquid soaps and underarm deodorants. This ingredient, coupled with fluoride and anti-tartar ingredients, has been formulated into a number of commercial toothpastes and mouth rinses worldwide in "multi-benefit" products directed toward the simultaneous control of dental caries, plaque, calculus and gingivitis. Formulations with proven clinical efficacy include dentifrices comprised of triclosan, Gantrez acid copolymer and sodium fluoride, triclosan, zine citrate and sodium mono fluoro phosphate, and triclosan, pyrophosphate and sodium fluoride.^[7]

Stannous fluoride (SnF) has a long tradition of use in toothpastes, mouth rinses and gels as an anticaries agent. The anticaries efficacy of stannous fluoride is proposed to result from combined actions on enamel mineral and bacterial plaque. Stannous fluoride exhibits antimicrobial effects against gram-negative and gram-positive bacteria. Stannous fluoride is a particularly potent inhibitor of *Streptococcus mutans* growth and metabolism.

Stannous fluoride has been examined for its effects on plaque and gingivitis in controlled clinical trials; however, the efficacy of SnF, against these conditions has previously only been described for anhydrous gels, mouth sprays or rinses. More recently, research was published demonstrating the clinical efficacy of a toothpaste formulation containing a stabilized form of stannous fluoride for the prevention of dental caries, gingivitis and gingival bleeding.^[8]

Muller et al conducted a study to evaluate the effect of triclosan/copolymer containing toothpaste on the association between plaque and gingival bleeding. The study concluded that Triclosan appears to attenuate the causal association between supragingival plaque and gingival bleeding in gingivitis.^[9]

Perlich et al conducted a study on the clinical effect of a stabilized stannous fluoride dentifrice on plaque formation, gingivitis and gingival bleeding. The study concluded that twice-daily use of a dentifrice containing 0.454% stabilized stannous fluoride significantly reduced gingivitis and gingival bleeding, relative to a 0.243% sodium fluoride containing dentifrice.^[10]

The need for the present study arose from the fact that, although numerous toothpastes are commercially available claiming to reduce plaque and gingival inflammation, Triclosan, being an established antibacterial and anti-inflammatory agent, has shown promising results in reducing gingival inflammation and plaque accumulation in previous studies. Several previous clinical trials evaluating triclosan and stannous fluoride containing toothpastes have employed longer study durations ranging from several months to assess sustained gingival health and plaque control. The present short study was designed to evaluate the **early and immediate clinical response** in terms of reduction of gingival bleeding. By limiting the study period to four weeks, the present study aims to identify which toothpaste demonstrates a **more rapid onset of action** in reducing gingival bleeding, while maintaining biological relevance, patient compliance, and feasibility within a short-term clinical study design. Therefore, this study was undertaken as a simple and practical clinical evaluation to assess and compare the short-term effects of triclosan-containing and non-triclosan toothpastes on plaque index, gingival index, and bleeding index in gingivitis patients.

II. Material And Methods

The study patients were selected from the subjects who visited the outpatient section of the Department of Periodontology, D.A.P.M.R.V Dental College, Bangalore. Ethical clearance was taken from the IRB (Institutional Review Board) of the Institution. The study was explained to the participants and written informed consent was obtained from each of the participant.

Study Design: Randomized clinical trial

Study Location: Department of periodontology, DAPMRV dental college, JP Nagar, Bangalore, Karnataka, India

Study Duration: August 2024 to August 2025

Sample size: 48 patients

Sample size calculation: Two Means - Hypothesis testing for two means (equal variances); Standard deviation in group I = 0.064; Standard deviation in group II = 0.065; Mean difference = 0.06
Effect size = 0.930232558139535; Alpha Error(%) = 5; Power(%)= 90; sided = 2

Required sample size per group = 24

Subjects & selection method: 48 participants were divided into two equal groups containing 24 patients each and divided into following groups.

Group I(N=24) received scaling and performed tooth brushing with 0.3%triclosan containing tooth paste. Group II(N=24) received scaling and performed tooth brushing with 0.454% stannous fluoride containing tooth paste (non-triclosan).

Inclusion criteria:

1. Patients (male or female) within the age range of 18-45 years.
2. 20 intact natural teeth
3. Plaque induced gingivitis (score of 1-2)
4. Free from active caries, periodontitis, or large restoration
5. Bleeding on probing

Exclusion criteria:

1. Smokers and smokeless tobacco users
2. Antibiotic and anti-inflammatory therapy for past three months.
3. Under corticosteroids therapy.
4. Expectant and nursing mothers
5. Denture wearers or those with crown and bridges
6. Known systemic diseases
7. Ongoing orthodontic therapy

Procedure methodology

Subjects were randomly selected from those diagnosed as plaque induced gingivitis with the clinical evidence of Bleeding on probing. 48 participants were divided into two equal groups containing 24 patients each and divided into following groups. Patients were randomly allocated in groups in either Group I or Group II and both groups served as test groups.

Group I (N=24) received scaling and performed tooth brushing with 0.3%triclosan containing toothpaste. Group II (N=24) received scaling and performed tooth brushing with 0.454% stannous fluoride containing toothpaste (non-triclosan).

Clinical parameters

Pre-treatment procedures

Clinical parameters such as Plaque Index (Silness and Loe 1964), Gingival Index (Loe and Silness 1963) and bleeding index (Muhlemann and sons) were recorded at baseline.

Calculation of parameters

PLAQUE INDEX(PI) (J.Silness and H.Loe, 1964)

Score 0- No plaque in the gingival area

Score 1- A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be recognized only by running a probe across the tooth surface.

Score 2- Moderate accumulation of soft deposits within the gingival pocket and on the gingival margin and /or adjacent tooth surface that can be seen by naked eye.

Score 3- Abundance of soft matter within the gingival pocket and / or on the gingival margin and adjacent tooth surface.

Four surfaces were scored for both the gingival and plaque indices.

PI for the individual= $\frac{\text{Total score for each of the teeth}}{\text{Total number of teeth examined}}$

GINGIVAL INDEX (GI) (H.Loe and J.Silness, 1963)

Score 0- normal gingiva

Score 1 – Mild inflammation; slight change in colour and slight edema. No bleeding on probing.

Score 2 -Moderate inflammation; redness, edema and glazing. Bleeding on probing.

Score 3- Severe inflammation; marked redness and edema. Ulceration, tendency towards spontaneous bleeding

GI for the individual = $\frac{\text{Total score for each of the teeth}}{\text{Total number of teeth examined}}$

BLEEDING INDEX (BI) (Muhlemann & Sons, 1971)

Score 0- Gingiva of normal texture and colour, no bleeding on probing.

Score 1- Gingiva apparently normal, bleeding on probing.
 Score 2- Bleeding on probing, change in colour, no oedema.
 Score 3- Bleeding on probing, change in colour, slight edema.
 Score 4- Bleeding on probing, change in colour, obvious edema.
 Score 5- Bleeding on probing and spontaneously bleeding, change in colour, marked edema.

Treatment procedures

1. After baseline examination thorough oral prophylaxis was done.
2. Participants were refrained from using any other oral hygiene aids other than brushing with prescribed dentifrice .
3. All subjects were instructed to apply pea size of prescribed dentifrice to the head of a soft bristled tooth brush, and instructed to brush their teeth for two minutes twice daily (morning and night).
4. Patients were asked to follow the brushing technique that they routinely follow.
5. Clinical assessment of gingival index, bleeding index, plaque index were done after 4 weeks from baseline examination.

Statistical analysis

Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were expressed as frequencies and percentages. The normality of the data was assessed before performing inferential analysis.

For comparison of PI, GI and BI scores between baseline and 4 weeks within each group, a paired-samples t-test was used. For comparison of the mean PI, GI and BI scores between the Triclosan and Non-Triclosan groups, an independent-samples t-test was used at baseline and at 4 weeks. Age was compared between the two groups using an independent-samples t-test, while sex distribution was compared using the chi-square test. A p-value <0.05 was considered statistically significant.

III. Result

DEMOGRAPHIC DETAILS

A total of 48 participants were included in the study, with 24 participants in each group.

1.1 Age Distribution: The mean age of the participants in the Triclosan group was 31.38 ± 7.07 years, while in the Non-Triclosan group it was 33.42 ± 7.01 years, with no statistically significant difference between the groups.

TABLE 1.1 SHOWS DISTRIBUTION OF AGE IN TRICLOSAN AND NON-TRICLOSAN GROUP

	Age			
	Count	Mean	Standard Deviation	P value
Triclosan	24	31.38	7.07	0.31
Non-Triclosan	24	33.42	7.01	

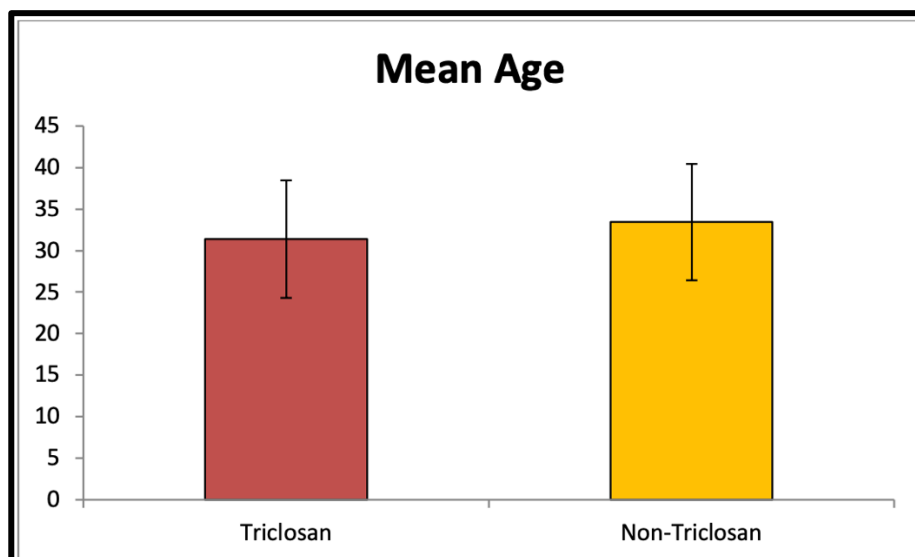


FIGURE 1.1: Mean age distribution of participants in Triclosan and Non-Triclosan groups with standard deviation.

1.2 Sex Distribution: In the Triclosan group, 54.2% were males and 45.8% were females, whereas in the Non-Triclosan group, 45.8% were males and 54.2% were females.

TABLE 1.2 DEPICTS THE SEX DISTRIBUTION AMONG TRICLOSAN AND NON-TRICLOSAN GROUPS

	Sex				P value
	Male		Female		
	N	%	N	%	
Triclosan	13	54.20%	11	45.80%	0.56
Non-Triclosan	11	45.80%	13	54.20%	

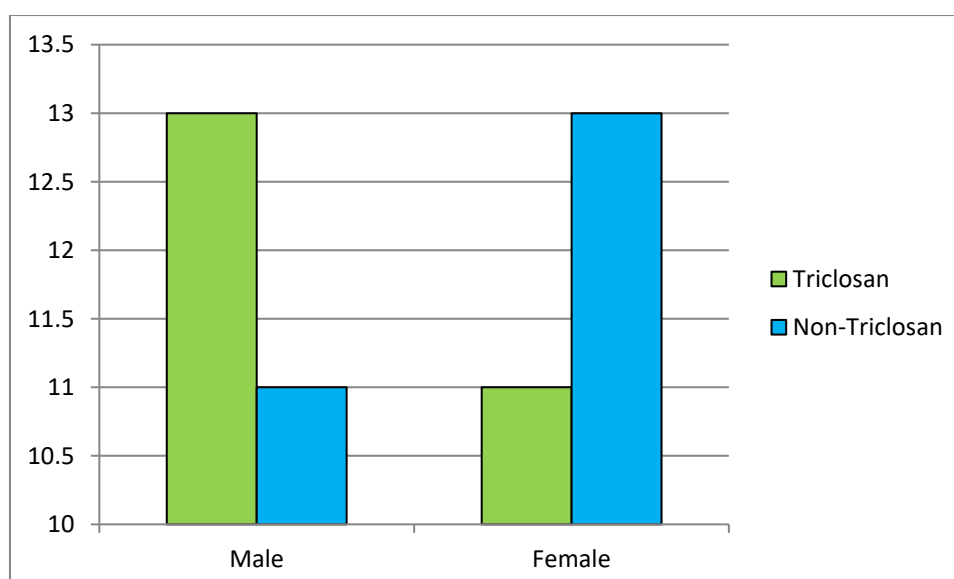


FIGURE 1.2 DEPICTS SEX DISTRIBUTION OF PARTICIPANTS IN TRICLOSAN AND NON-TRICLOSAN GROUP

INTRAGROUP COMPARISON

TABLE 2 depicts Comparison of PI, GI, BI between Baseline and 4 weeks among Triclosan and Non-Triclosan Tooth paste

			N	Mean	SD	t	P value
Triclosan	PI	Baseline	24	1.97	0.19	42.643	0.001*
		Week 4	24	1.11	0.22		
	GI	Baseline	24	1.82	0.17	43.121	0.001*
		Week 4	24	1.06	0.18		
	BI	Baseline	24	2.22	0.28	40.605	0.001*
		Week 4	24	1.20	0.30		
Non-Triclosan	PI	Baseline	24	1.95	0.18	40.5	0.001*
		Week 4	24	1.38	0.20		
	GI	Baseline	24	1.77	0.20	25.499	0.001*
		Week 4	24	1.33	0.18		
	BI	Baseline	24	2.17	0.32	22.097	0.001*
		Week 4	24	1.59	0.31		

*Statistical significance set at 0.05; N: Number of samples; SD: Standard deviation

PI: Plaque Index

GI: Gingival Index

BI: Bleeding Index

Interpretation:

Triclosan Group

Plaque Index (PI)

A paired-sample t-test demonstrated a statistically significant reduction in Plaque Index (PI) scores from baseline (M = 1.97, SD = 0.19) to Week 4 (M = 1.11, SD = 0.22), $p < 0.001$.

Gingival Index (GI)

A paired sample t-test demonstrated a statistically significant reduction in gingival index (GI) scores from baseline (M = 1.82, SD = 0.17) to Week 4 (M = 1.06, SD = 0.18), $p < .001$.

Bleeding Index (BI)

A paired sample t-test demonstrated a statistically significant reduction in bleeding index (BI) score from baseline (M = 2.22, SD = 0.28) to Week 4 (M = 1.20, SD = 0.30), $p < .001$.

Non-Triclosan Group

Plaque Index (PI)

In the Non Triclosan group, PI scores showed a statistically significant decline from baseline (M = 1.95, SD = 0.18) to Week 4 (M = 1.38, SD = 0.20), $p < .001$.

Gingival Index (GI)

A statistically significant reduction was observed in GI scores from baseline (M = 1.77, SD = 0.20) to Week 4 (M = 1.33, SD = 0.18), $p < .001$.

Bleeding Index (BI)

The Non Triclosan group also demonstrated a statistically significant improvement in BI scores from baseline (M = 2.17, SD = 0.32) to Week 4 (M = 1.59, SD = 0.31), $p < .001$.

3. INTERGROUP COMPARISON

TABLE 3 depicts comparison of PI, GI, BI between Triclosan and Non- Triclosan Tooth paste at Baseline and 4weeks

		Groups	N	Mean	SD	t	P value
PI	Baseline	Triclosan	24	1.97	0.19	0.436	0.665
		Non-Triclosan	24	1.95	0.18		
	Week 4	Triclosan	24	1.11	0.22	-4.447	0.001*
		Non-Triclosan	24	1.38	0.20		
GI	Baseline	Triclosan	24	1.82	0.17	0.854	0.398
		Non-Triclosan	24	1.77	0.20		
	Week 4	Triclosan	24	1.06	0.18	-5.312	0.001*
		Non-Triclosan	24	1.33	0.18		

		Non-Triclosan	24	1.33	0.18		
BI	Baseline	Triclosan	24	2.22	0.28	0.489	0.627
		Non-Triclosan	24	2.17	0.32		
	Week 4	Triclosan	24	1.20	0.30	-4.427	0.001*

Interpretation:

An independent samples *t*-test was conducted to compare the mean scores of Plaque Index (PI), Gingival Index (GI), and Bleeding Index (BI) between the Triclosan and Non-Triclosan groups at baseline and after four weeks.

Plaque Index (PI)

At baseline, there was no statistically significant difference in PI scores between the Triclosan group (M = 1.97, SD = 0.19) and the Non Triclosan group (M = 1.95, SD = 0.18), $p = .665$. At Week 4, the Triclosan group (M = 1.11, SD = 0.22) demonstrated a statistically significant reduction in PI scores compared to the Non Triclosan group (M = 1.38, SD = 0.20), $p < .001$.

Gingival Index (GI)

At baseline, no statistically significant difference was observed between the Triclosan group (M = 1.82, SD = 0.17) and the Non Triclosan group (M = 1.77, SD = 0.20), $p = .398$. At Week 4, the Triclosan group (M = 1.06, SD = 0.18) had statistically significant reduction in GI scores compared to the non-Triclosan group (M = 1.33, SD = 0.18), $p < .001$.

Bleeding Index (BI)

At baseline, BI scores were comparable between the Triclosan group (M = 2.22, SD = 0.28) and the Non Triclosan group (M = 2.17, SD = 0.32), $p = .627$. At Week 4, the Triclosan group (M = 1.20, SD = 0.30) reported statistically significant reduction in BI scores compared to the Non Triclosan group (M = 1.59, SD = 0.31), $p < .001$.

IV. Discussion

Dental plaque is a complex biofilm composed of broad spectrum of microbial species. Accumulation of dental plaque was seen along the gingival margin, if it is not interrupted. This will provoke the inflammatory response of the gingiva termed as gingivitis. Clinically perceived as gingival redness, swelling, bleeding on probing. Effective plaque control remains as the cornerstone in the prevention and management of gingival inflammation. Mechanical plaque control remains gold standard along with the usage of chemical plaque control like dentifrices with chemotherapeutic agents to control plaque deposition and to improve gingival health. In chemical plaque control, chemotherapeutic agents like triclosan, stannous fluoride, bis biguanides, tetracyclines etc. are used. Among these, in this study Triclosan and Stannous fluoride containing tooth paste was compared to evaluate their efficacy in reducing plaque index, gingival index and bleeding index in 4 weeks duration. The need for the present study was designed to evaluate the early and immediate clinical response of 0.3% triclosan and 0.454% Stannous fluoride in the duration of 4 weeks in gingivitis patients as the previous studies have evaluated the long-term effects of these agents. [30][31][32]

In the present randomized clinical study, both the triclosan-containing and non-triclosan (stannous fluoride) toothpaste groups demonstrated statistically significant reductions in plaque index, gingival index, and bleeding index after four weeks. However, the triclosan group showed **significantly greater reductions** in all three clinical parameters compared to the non-triclosan group at the end of four weeks, indicating a superior adjunctive benefit.

In the present study, the triclosan group demonstrated a marked reduction in bleeding index and gingival index within four weeks, suggesting a rapid modulation of gingival inflammatory response. This finding is in agreement with **Müller et al.**, who reported that triclosan attenuates the association between supragingival plaque and gingival bleeding, indicating that triclosan may reduce gingival inflammation even in the presence of residual plaque. Similar observations have been reported in clinical trials by **Lindhe et al.**[20] and **Gunsolley et al.**[21] where triclosan-containing dentifrices consistently showed superior anti gingivitis effects compared to conventional fluoride toothpastes.

Triclosan group illustrated a marked reduction in plaque index within 4 weeks. This is in accordance with the findings highlighted by **Moran et al.**, who reported that triclosan toothpaste reduced plaque compared to other non-triclosan tooth paste groups. He also stated that reduction in plaque would most likely due to the presence of triclosan in the formulation.[34]

The enhanced clinical performance of triclosan observed in the present study may be explained by its **dual antibacterial and anti-inflammatory mechanisms of action**. Triclosan is a broad-spectrum antimicrobial agent that inhibits bacterial fatty acid synthesis by targeting enoyl-acyl carrier protein reductase, thereby suppressing bacterial growth and reducing plaque accumulation. In addition to its antibacterial action, triclosan has been shown to exert a direct anti-inflammatory effect by inhibiting cyclooxygenase and lipoxigenase

pathways, leading to reduced production of inflammatory mediators such as prostaglandin E₂ (PGE₂).^[33] By reducing the inflammatory mediators and suppressing the bacterial growth it leads to the reduction in plaque accumulation which leads to reduction in gingival inflammation and gingival bleeding.

On the other side, Stannous fluoride, used in the non-triclosan group, is a well-established anticaries agent with additional antimicrobial properties. It exerts its action by disrupting bacterial metabolism, inhibiting plaque acidogenicity, and forming a protective tin-rich layer on enamel surfaces. Stabilized stannous fluoride formulations have also been reported to reduce gingival bleeding by limiting bacterial virulence and plaque maturation.^[32] In the present study, the stannous fluoride group showed significant improvement in plaque, gingival, and bleeding indices, which is consistent with findings from studies by **Perlich et al.**^[10] and **Parkinson et al.**^[8] However, the magnitude of reduction was comparatively less than that observed in the triclosan group.

The superior performance of triclosan over stannous fluoride in this short-term study may be attributed to its greater substantivity and pronounced anti-inflammatory action, which allows it to exert clinical effects within a shorter duration. The significant intergroup differences observed at four weeks indicate that triclosan has a faster onset of action in reducing plaque-induced gingival inflammation.

Thus, within the limitations of the study, the findings suggest that while both dentifrices are effective adjuncts to mechanical plaque control, triclosan-containing toothpaste provides superior short-term benefits in reducing plaque accumulation, gingival inflammation, and bleeding. This makes triclosan a valuable adjunct in the initial management of gingivitis, especially when rapid clinical improvement is desired.

V. Conclusion

In conclusion, the present study supports the adjunctive use of Triclosan-containing toothpaste as an effective means of improving gingival health when used alongside with daily oral care.

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