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Research Article

Comparative evaluation of the effect of Green tea, Listerine and Chlorhexidine mouth washes in gingivitis patients: A randomized controlled trial

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Abstract: This study is aimed to evaluate and compare the effects of commercially available Green Tea mouth wash with Listerine and Chlorhexidine mouth wash in gingivitis patients. 48 patients, underwent scaling and were randomly categorized into 4 groups i.e. Group I: patients received green tea, Group II: patients received Chlorhexidine mouthwash, Group III: patients received Listerine mouthwash and Group IV: patients who received placebo mouthwash (distilled water) .The plaque index, gingival index and bleeding index of the patients were recorded at baseline followed by scaling and at 14th day and 21st day, postoperatively. The results demonstrated Green tea to be equally effective in reducing the periodontal indices as Chlorhexidine. Significant reduction was seen in plaque, gingival and bleeding indices in all the groups. Use of Green tea mouthwash is an effective antiplaque agent that is comparable to Chlorhexidine mouthwash and can be used as an adjunct to regular mechanical plaque control practices and professional scaling, in gingivitis patients.
Keywords: Green tea (Colgate plax Fresh tea®), Gingivitis, Chlorhexidine, Listerine.

INTRODUCTION

Mechanical and chemical plaque control are the most effective method in preventing periodontal disease. Several plant extracts have been widely used in topical and oral applications for disease treatment[1]. Some of these substances have been associated with side effects limiting their long term use. Of the many herbal extracts Green tea (*Camellia sinensis)* has numerous medicinal benefits mainly due to its antibacterial and antioxidant properties[2]. Green tea contains phenolic phytochemicals with promising properties to benefit human health which includes a group of polyphenol compounds called catechins[3].

The remedial effects are associated with the catechins present in green tea comprising of eppigallocatechin gallate (EGCG), epicatechin gallate (ECG), epicatechin (EC) and epigallocatechin (EGC)[4]. It was suggested that EGCG inhibits the growth and adherence of periodontal pathogens[5].

Various chemical agents have been advocated for the prevention of dental plaque which are either available as dentifrices or in the form of a mouthwash. Although Chlorhexidine regarded as the gold standard for prevention of dental plaque is associated with certain side effects. Hence there is a need for a naturally occurring indigenous and cost effective oral hygiene aid.

Thus the aim of the study was to evaluate the efficacy of green-tea mouthwash as an antiplaque agent.

To the best of our knowledge, previous studies [1, 6-8] that have been carried out regarding green tea and its effect on oral cavity, the green tea solution was prepared in the laboratory and then dispensed for use.

In this study the effect of a commercially available green tea mouth wash(Colgate plax Fresh tea®), was compared with other commercially available Chlorhexidine and Listerine mouth wash.

MATERIALS AND METHODS:

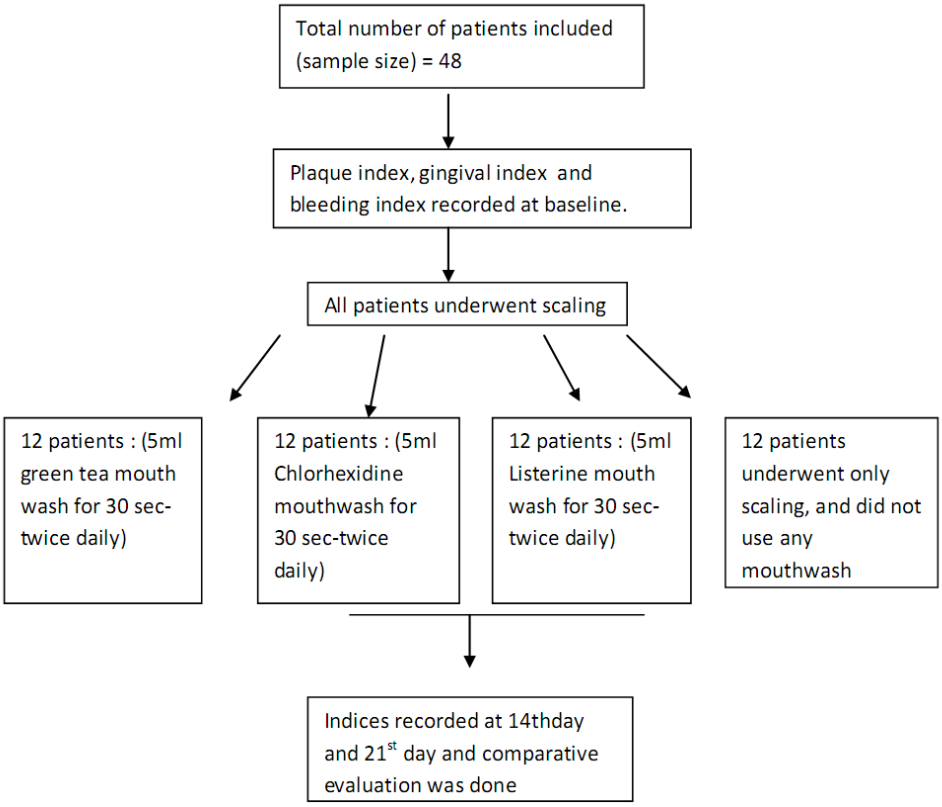
A parallel designed randomized controlled clinical trial was conducted among patients with chronic generalized plaque-induced gingivitis visiting the Department of Periodontology, Rajarajeswari Dental College, Bangalore. All the patients were explained about the study protocol and informed consent was obtained from each subject. Patients with chronic generalized gingivitis and patients with plaque index score ≥1 were included in the study.

Factors as exclusion criteria were medically compromised patients, any long term medications,

smokers and patient who had used any type of antibacterial mouthwash in 4weeks of commencement.

Final recruited patients were distributed into 4 groups. A total of 48 patients were included and evaluated. All the patients underwent scaling following which they were grouped as: Group 1- 12 patients received green tea mouthwash , Group 2- 12 patients received Chlorhexidine mouthwash, Group 3- 12 patients received Listerine mouthwash and Group 4- 12 patients underwent only scaling and did not use any mouthwash. All patients were instructed to use the mouth wash two times a day, each time 5 ml rinsed for 30 seconds. The Plaque index (Loe & Sillness) , gingival index (Sillness and Loe) and sulcus bleeding index (Muhlemann) of each patient was recorded at baseline, 14th day and 21st day postoperatively.

A flow chart based on the patient allotment and study protocol has been described as follows:



Statistical analysis

Kruskal Wallis test was used to compare the four groups with respect to plaque index and gingival index scores at baseline, 14 day and 21 day and their differences from baseline. Pair wise comparisons of each group regarding plaque and gingival index were done by by Mann-Whitney U test. Comparison of four groups with respect to sulcus bleeding index scores and their differences from baseline by one way ANOVA. Pair wise comparisons regarding sulcus bleeding index was done by Tukeys multiple post hoc. *P* value ≤0.05 was considered statistically significant.

RESULTS

The plaque index, gingival index and sulcus bleeding index scores when compared from baseline to the 14th day and 21st day postoperatively showed statistically significant reduction in all the groups.

Difference between the Green tea group and Chlorhexidine group in relation to the plaque index showed better results in the Green tea group and was significant from baseline to the 21st day revisit score (P=0.0244) and similarly Green tea was also better when compared to Listerine group and showed a significant difference in the 21st day revisit scores (0.0464).

With respect to the gingival index scores, Green tea showed better results than chlorhexidine group, though it was not statistically significant. Difference between the Green tea and Listerine group showed statistically significant better results in the green tea group (0.0079) at 21st day postoperatively.

In regard to the sulcus bleeding index, comparison between Green tea and Chlorhexidine group showed better results in the Chlorhexidine group at 21st day postoperatively however Green tea group showed better results when compared to Listerine group at the 21st day interval.

A detailed comparison among all the groups related to each index and their values have been listed in the following tables:

Table 1: Comparison of four groups with respect to plaque index scores at baseline, 14 day and 21 day and their differences from baseline by Kruskal Wallis ANOVA

Group	Baseline		14th day		21st day		Changes from baseline to					
							BL-14day		BL-21day		14day - 21day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Green tea group	1.59	0.56	1.03	0.47	0.79	0.27	0.56	0.27	0.80	0.44	0.24	0.33
Chlorhexidine group	1.61	0.55	1.23	0.46	1.08	0.43	0.38	0.20	0.53	0.34	0.15	0.17
Listerene group	1.59	0.44	1.31	0.37	1.15	0.37	0.28	0.13	0.44	0.16	0.16	0.09
Scaling group	1.62	0.51	1.35	0.39	1.08	0.41	0.27	0.18	0.54	0.25	0.28	0.11
% of change in GT							35.08%#, p=0.00001*		50.26%#, p= 0.0001*		23.39%#, p=0.0262*	
% of change in CH							23.83%#, p=0.00001*		33.16%#, p=0.0002*		12.24%#, p=0.0102*	
% of change in LT							17.80 %#, p=0.00001*		27.75%#, p=0.00001*		12.10%#, p=0.0001*	
% of change in SC							16.49 %#, p=0.0003*		33.51%#, p=0.00001*		20.37%#, p= 0.00001*	
H-value	0.2740		3.6140		6.0730		10.5870		4.7440		6.5400	
P-value	0.9650		0.3060		0.1080		0.0140 *		0.1920		0.0880	
Pair wise comparisons by Mann-Whitney U test												
GT vs SC	P=0.7950		P=0.1124		P=0.1190		P=0.0073 *		P=0.1572		P=0.0941	
GT vs LT	P=1.0000		P=0.1572		P=0.0244*		P=0.0073*		P=0.0464*		P=0.8625	
GT vs CH	P=0.9540		P=0.2366		P=0.0464 *		P=0.1124		P=0.1489		P=0.7950	
SC vs LT	P=0.5067		P=0.5254		P=1.0000		P=0.6650		P=0.4189		P=0.0179 *	
SC vs CH	P=0.7508		P=0.4705		P=0.8852		P=0.1749		P=0.9770		P=0.0464 *	
LT vs CH	P=0.8399		P=0.5444		P=0.4357		P=0.2855		P=0.5254		P=0.8174	

*p<0.05, # applied Wilcoxon matched pairs test by ranks

Table2: Comparison of four groups with respect to gingival index scores at baseline, 14 day and 21 day and their differences from baseline by Kruskal Wallis ANOVA

Group	Baseline		14th day		21st day		Changes from baseline to					
							BL-14day		BL-21day		14day - 21day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Green tea group	1.57	0.39	1.21	0.37	0.82	0.32	0.36	0.13	0.75	0.38	0.39	0.31
Chlorhexidine group	1.48	0.43	1.20	0.40	0.94	0.37	0.28	0.17	0.54	0.23	0.26	0.19
Listerene group	1.82	0.28	1.53	0.22	1.14	0.31	0.28	0.11	0.68	0.16	0.39	0.22
Scaling group	1.45	0.53	1.25	0.53	1.09	0.45	0.20	0.11	0.36	0.12	0.16	0.13
% of change in GT							22.87%#, p=0.00001*		47.87%#, p=0.00001*		32.41%#, p=0.0012*	
% of change in CH							19.10%#, p=0.0002*		36.52%#, p=0.00001*		21.53%#, p=0.0006*	
% of change in LT							15.60 %#, p=0.00001*		37.16%#, p=0.00001*		25.54%#, p=0.0001*	
% of change in SC							13.79 %#, p=0.0001*		24.71%#, p=0.00001*		12.67%#, p=0.0015*	
H-value	7.5090		7.2380		7.3040		7.6090		13.6580		7.1830	
P-value	0.0500*		0.0650		0.0630		0.0500*		0.0030*		0.0660	
Pair wise comparisons by Mann-Whitney U test												
GT vs CH	P=0.4189		P=0.8399		P=0.3709		P=0.2254		P=0.1124		P=0.3408	
GT vs LT	P=0.0999		P=0.0194		P=0.0079*		P=0.1333		P=0.3865		P=0.9770	
GT vs SC	P=0.2855		P=0.7075		P=0.0783		P=0.0073*		P=0.0130*		P=0.1060	
CH vs LT	P=0.0244*		P=0.0304*		P=0.1410		P=0.7075		P=0.2040		P=0.1489	
CH vs SC	P=0.5067		P=0.9540		P=0.3865		P=0.3408		P=0.0606		P=0.1939	
LT vs SC	P=0.0282		P=0.0497		P=0.6033		P=0.1124		P=0.0003*		P=0.0086*	

*p<0.05, # applied Wilcoxon matched pairs test by ranks

Table 3: Comparison of four groups with respect to sulcus bleeding index scores at baseline, 14 day and 21 day and their differences from baseline by one way ANOVA

Group	Baseline		14th day		21st day		Changes from baseline to					
							BL-14day		BL-21day		14day - 21day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Green tea group	2.86	0.35	2.59	0.33	2.32	0.26	0.27	0.12	0.54	0.19	0.28	0.19
Chlorhexidine group	2.81	0.41	2.51	0.39	2.26	0.28	0.30	0.13	0.55	0.18	0.25	0.19
Listerene group	2.73	0.36	2.57	0.34	2.38	0.31	0.17	0.07	0.36	0.16	0.19	0.15
Scaling group	2.67	0.29	2.52	0.25	2.26	0.25	0.15	0.08	0.41	0.18	0.26	0.18
% of change in GT							9.33%#, p=0.00001*		18.95%#, p= 0.00001*		10.61%#, p=0.0003*	
% of change in CH							10.68 %#, p=0.00001*		19.58%#, p=0.00001*		9.97%#, p=0.0009*	
% of change in LT							6.10 %#, p=0.00001*		13.11%#, p=0.00001*		7.47%#, p=0.0010*	
% of change in SC							5.63 %#, p=0.00001*		15.31%#, p=0.00001*		10.26%#, p=0.0004*	
F-value	0.6810		0.1728		0.4935		5.9425		3.5380		0.4987	
P-value	0.5684		0.9142		0.6887		0.0017*		0.0222*		0.6851	
Pair wise comparisons by Tukeys multiple post hoc [procedures												
GT vs CH	0.9856		0.9275		0.9542		0.8636		0.9995		0.9858	
GT vs LT	0.8220		0.9978		0.9542		0.1052		0.0679		0.6622	
GT vs SC	0.5500		0.9457		0.9542		0.0438		0.2663		0.9957	
CH vs LT	0.9539		0.9732		0.7285		0.0165		0.0521		0.8524	
CH vs SC	0.7603		0.9999		1.0000		0.0058		0.2183		0.9995	
LT vs SC	0.9669		0.9829		0.7285		0.9797		0.8996		0.7952	

*p<0.05, # applied paired t test

The graphical representation of the results are listed as follows:

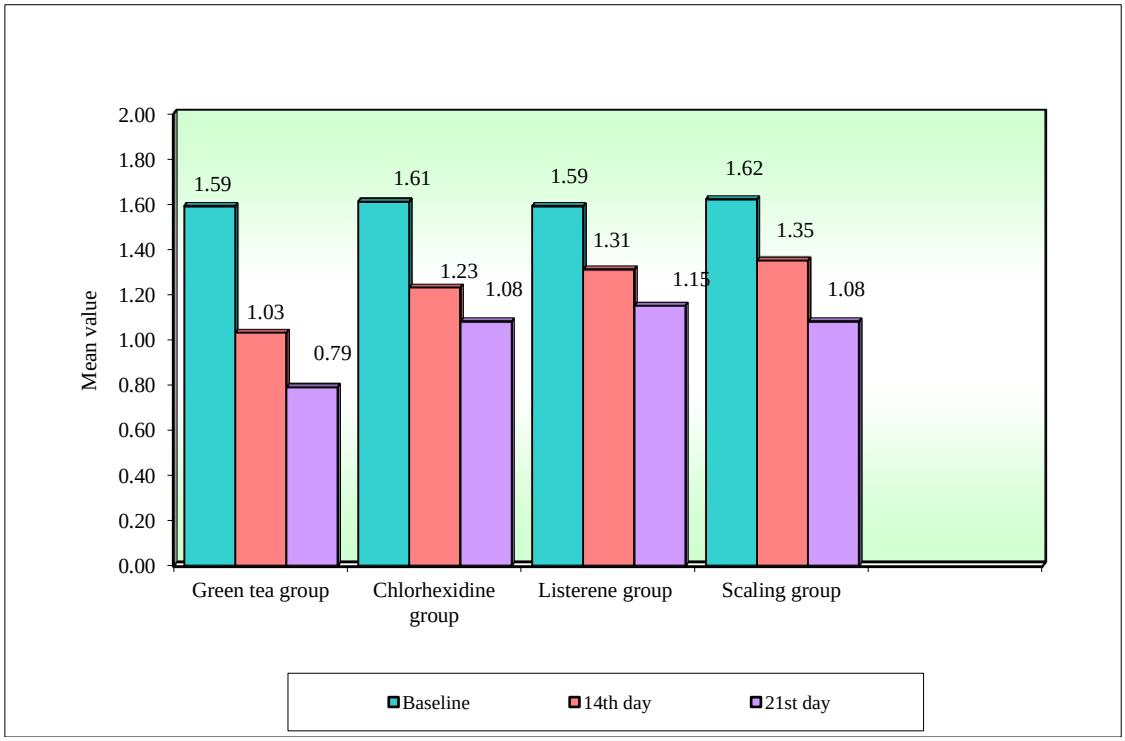


Fig-1:Comparison of four groups with respect to plaque index scores at baseline, 14 day and 21 day and their differences from baseline

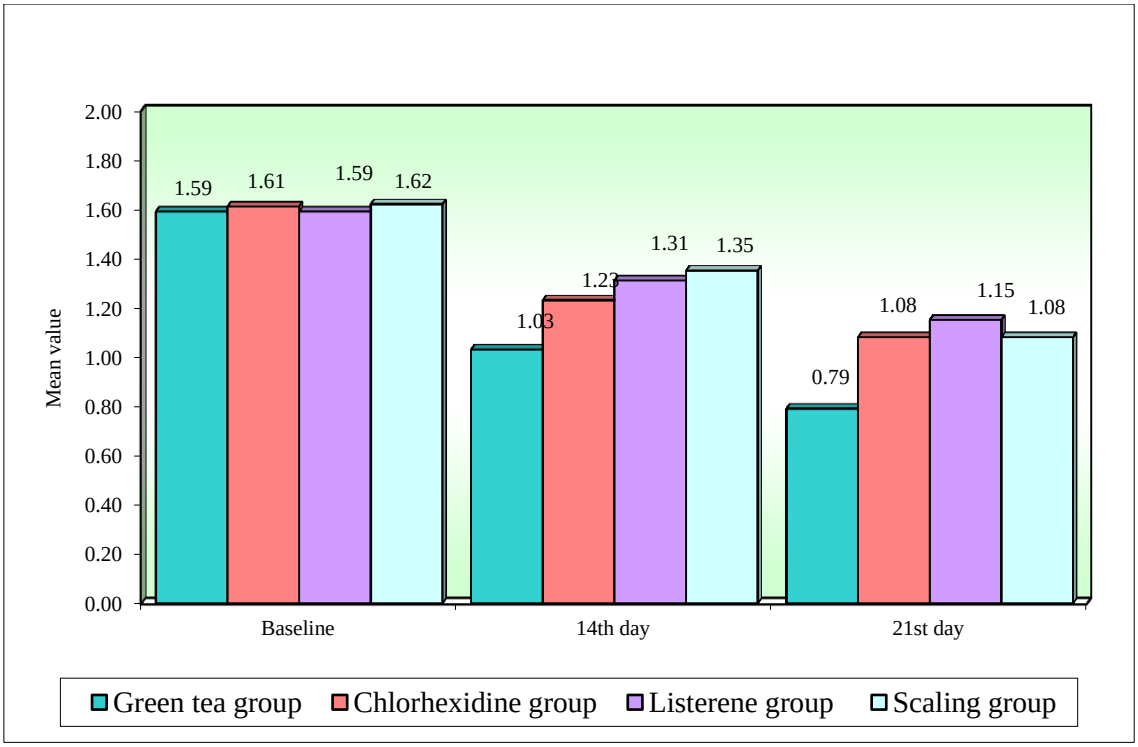


Fig- 2:Comparison of four groups with respect to plaque index scores at baseline, 14 day and 21 day and their differences from baseline

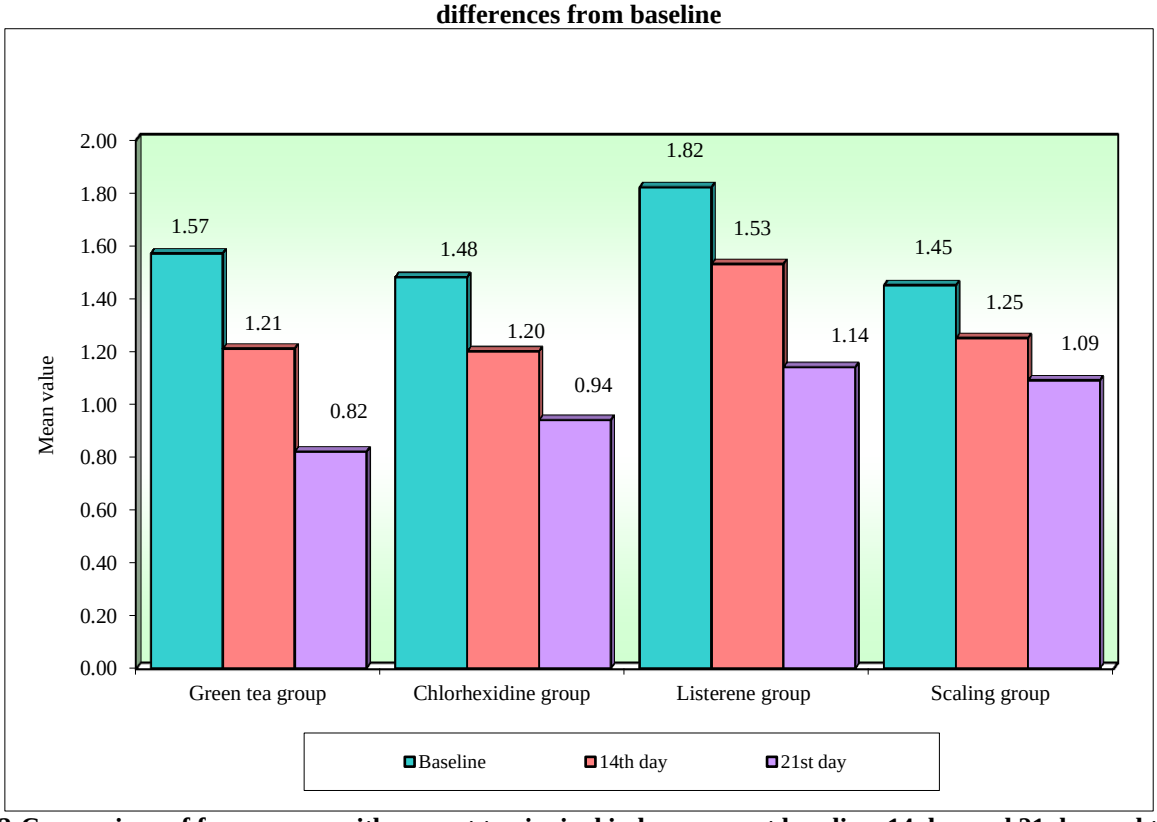


Fig-3:Comparison of four groups with respect to gingival index scores at baseline, 14 day and 21 day and their differences from baseline

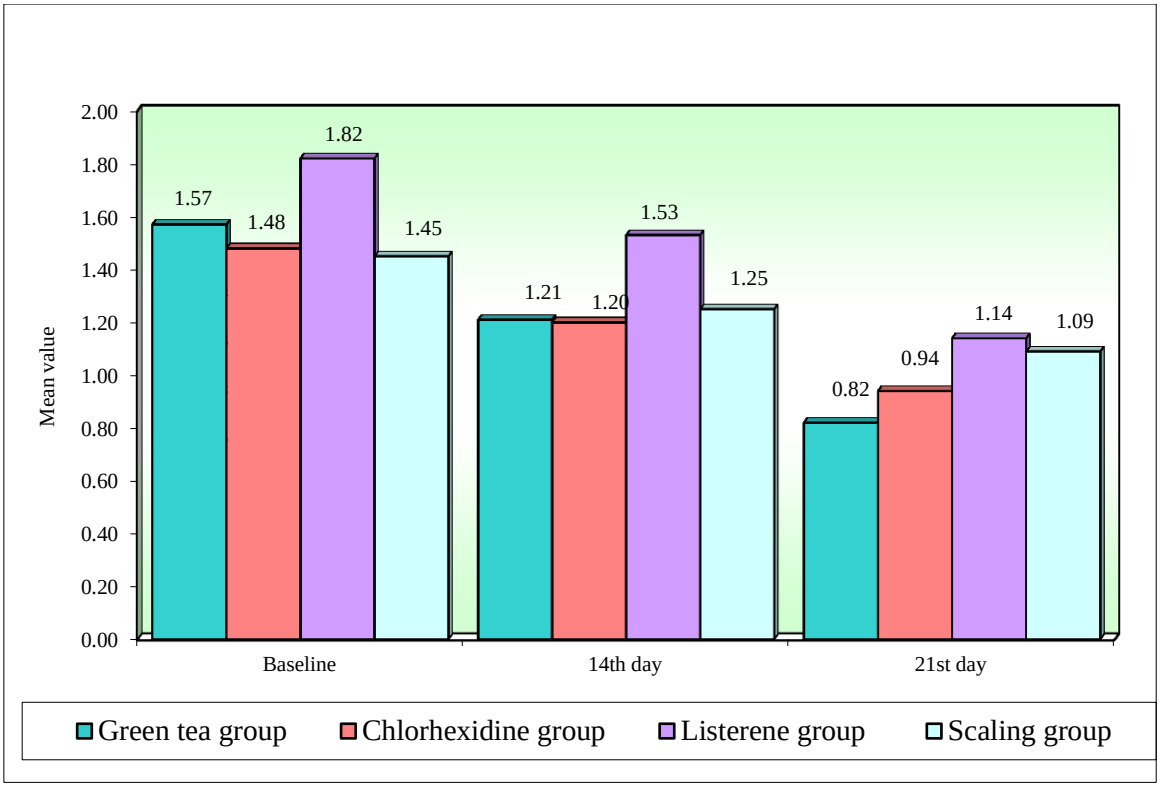


Fig-4:Comparison of four groups with respect to gingival index scores at baseline, 14 day and 21 day and their differences from baseline

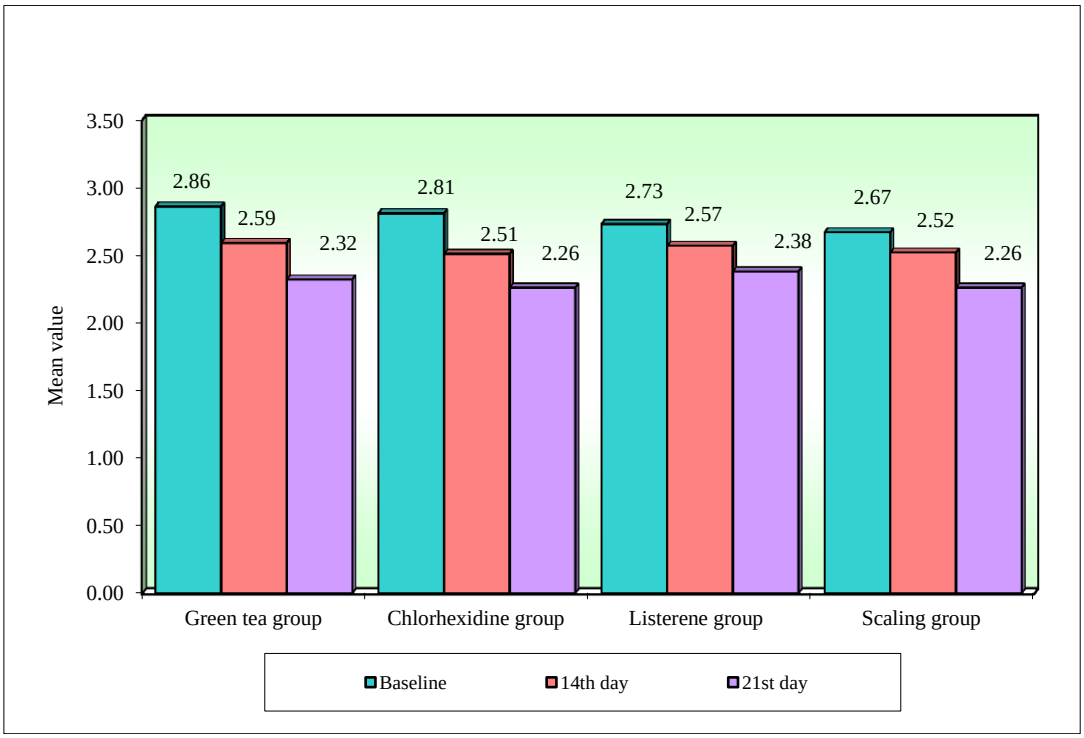


Fig-5:Comparison of four groups with respect to bleeding index scores at baseline, 14 day and 21 day and their differences from baseline

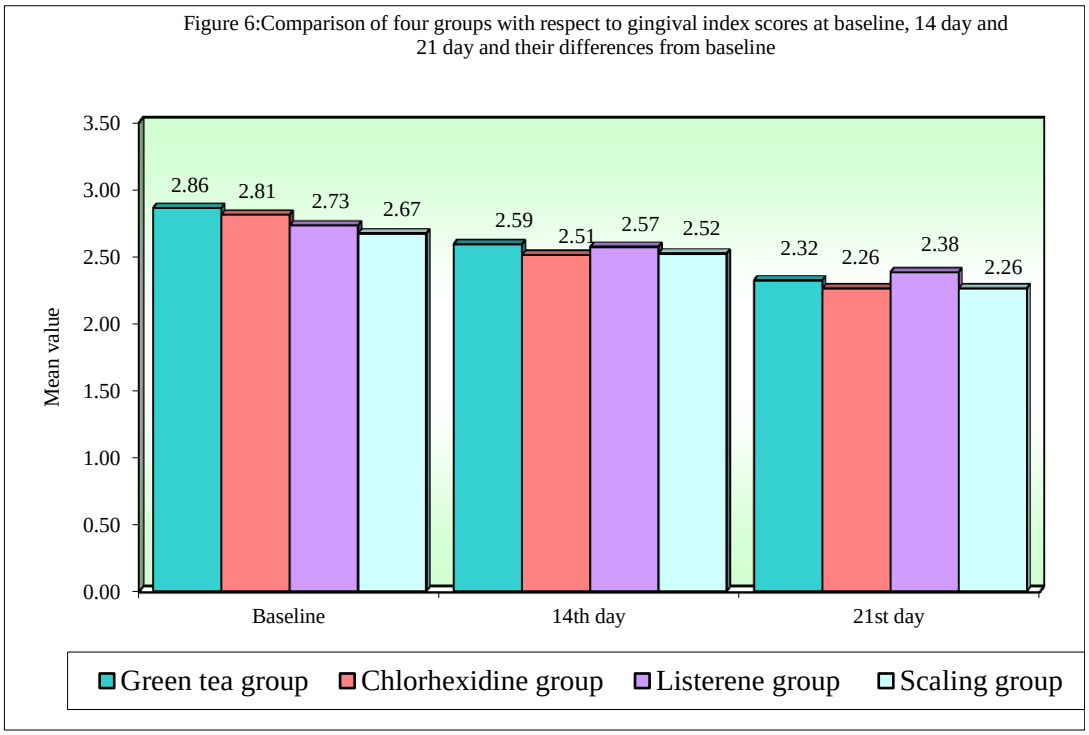


Fig- 6:Comparison of four groups with respect to gingival index scores at baseline, 14 day and 21 day and their differences from baseline

DISCUSSION

The present study evaluated the effect of mouth wash containing green tea on chronic generalized plaque-induced gingivitis, in comparison with 0.2% Chlorhexidine and Listerine mouthwash. The percentage reduction of plaque index, gingival index and sulcus bleeding index in the green tea group was 50.26%, 47.87%, 18.95% respectively from baseline to 21st day. The control group (scaling group) also had a reduction in the indices because of positive effects of scaling.

Green tea contains flavonoids, tannin, vitamins, fluoride and other mineral salts which have a potent anti-bacterial effect[15-17]. Green tea also consists of catechins, which showed an in vitro bactericidal activity against odor-producing, periodontal bacteria, P. gingivalis and Prevotella sp. and also inhibits adherence of P. gingivalis to oral epithelial cells[5-8].

Recently, Kudva et al. investigated the adjunctive effect of SRP and locally delivered catechin via inserted strips into the surrounding pocket for a period of 21 days.[13] They reported a significant decrease in pocket probing depth ($P < 0.001$)yet PI and GI decreased insignificantly when compared to the SRP group ($P < 0.05$). In addition, a considerable reduction of causative bacteria was observed[9].

Rassameemasmaung et al studied the effect of green tea mouthwash on oral malodour, plaque and gingival inflammation in gingivitis patients and at the end of 28 days study period the VSC score reduced by 38.61% along with significant reduction in the plaque index and papillary bleeding index scores[28].

In another study Moghbel et al assessed the effects of green tea leaves extract on the aerobic mouth bacterial load. A comparative study was conducted on a green tea mouthwash containing 1% tannin with 10% ethanol, an alcohol free mouthwash, and a green tea herbal mouthwash with a Chlorhexidine 0.2% sample. The herbal green tea extract reduced the aerobic mouth bacterial load by about 32% and prevented plaque formation on teeth [29].

The results of this study was comparable with a study conducted by Jenabian et al where they compared the effects of green tea mouthwash with another placebo group using saline, along with the routine mechanical plaque control methods. They concluded that a significant improvement was observed in all periodontal indices i.e gingival index, plaque index and bleeding index, during the study [30].

Compounds present in green tea have been studied on dental caries which have shown anticariogenic potential[24,25]. Animals and humans given tea compounds in their drinking water develop fewer dental caries and less plaque formation than those drinking plain water[26]. Drinking green tea may also help prevent sore throats and colds, since it helps fight the bacteria harbouring in the throat. Green tea may prevent bad breath by daily consumption, using it as a

mouthwash before and after brushing teeth, or mixing it with the toothpaste products[27].

The improvements in plaque and bleeding indices using green tea mouth wash, in our study are in commitment with many previous studies[10-14].

The study limits itself with small sample size and lack of microbiological assessment. However the present study suggests that green tea is a promising adjunctive aid in plaque control.

Chlorhexidine has been regarded as a "gold" standard in dentistry for the prevention of plaque and gingivitis. Studies have shown large reductions in plaque formation using Chlorhexidine gluconate, applied topically or as a mouth rinse. The results indicated that twice daily mouth rinse with 0.2% Chlorhexidine gluconate effectively prevented plaque formation[22-27]. In our study, Chlorhexidine mouthwash showed significant reduction in mean plaque and gingival score. In the inter group comparison, it was observed that the reduction in the indices score in the Green tea group was comparable to that of Chlorhexidine group.

CONCLUSION

Within the limitation of the study it can be said that the daily use of green tea mouthwash as an adjunct to mechanical plaque control method may be beneficial to prevent gingival inflammation and reduce plaque scores.

REFERENCES

1. Moghbel A, Hemmati A, Agheli H, Amraee K, Rashidi I; The effect of tragacanth mucilage on the healing of full-thickness wound in rabbit. Archives of Iranian Medicine, 2005;8(4):257-62.
2. David W, Sifton R; PDR for herbal medicines. 4th ed: Thomason ; 2004 :408- 14.
3. Mukhtar H, Grupta H, Ahmad N; Inhibition of nuclear transcription factor NFKB by green tea constituent epigallocatechin 3- gallate in human epidermoid carcinoma cells A 431.J dermatol Sci ,1998;16:50-55.
4. Graham HN; Green tea composumption and polyphenol chemistry. Preventive Medicine, 1992;21:334-350.
5. Hirasawa M, Takada K, Makimura M, Otake S; Improvement of periodontal status by gree tea cathechin using a local delivery system:a clinical pilot study.J Peridontol Research, 2002;37:433-438.
6. Sakanaka S, Aizawa M, Kim M, Yamamoto T; Inhibitory effect of green tea polyphenols on growth and cellular adherence of an oral bacterium, P.gingivalis.Bioscience,biotechnology and biochemistry, 1996;60:745-749..
7. Makimura M, Hirasawa M, Kobayashi K; Inhibitory effect of tea cathechins on collagenase activity. J periodontal, 1993;64;630-636.
8. Okamoto M, Sugimoto A, Leung P, Nakayama K, Kamaguchi A, Maeda N; Inhibitory effect of green tea cathechins on cysteine proteinases in Porphyromonas gingivalis. Oral Microbiology and immunology, 2004;19:118-120.
9. Kudva P, Tabasum ST, Shekhawat NK; Effect of green tea catechin, a local drug delivery system as an adjunct to scaling and root planing in chronic periodontitis patients: A clinicomicrobiological study**.** J Indian Soc Periodontol, 2011;15:39-45.
10. Pavel L, Pave S; Usefulness of micronutrients in the treatment of periodontitis Ned Tijdschr Tandheelkd. 2010;11:103-6.
11. Kushiyama M, Shimazaki Y, Murakami M, Yamashita Y; Relationship between intake of green tea and periodontal disease. J Periodontol, 2009;80:372-7.
12. Pistorius A, Willershausen B, Steinmeier EM, Kreislert M; Efficay of subgingival irrigation using herbal extracts on gingival inflammation. J periodontal, 2003;74:616-22.
13. Liu T, Chie Y; Experimental study on polyphenol anti-plaque effect in human. Zhonghua Kou Qiang Yi Xue Za Zhi, 2000;35:383-4.
14. Hamilton-Miller JMT; Anti-cariogenic properties of tea (Camellia Sinensis).J Med Microbiol, 2001;50:299-302
15. Berube-Parent S, Pelletier C, Dore J, Tremblay A; Effects of encapsulated green tea and Guarana extracts containing a mixture of epigallocatechin-3-gallate and caffeine on 24 h energy expenditure and fat oxidation in men. Br J Nutr., 2005;94(3):432-6.
16. Ferrara L, Montesano D, Senatore A; The distribution of minerals and flavonoids in the tea plant (Camellia sinensis). Farmaco, 2001;56(5-7):397-401.
17. du Toit R, Volsteedt Y, Apostolides Z; Comparison of the antioxidant content of fruits, vegetables and teas measured as vitamin C equivalents. Toxicology, 2001;166(1-2):63-9.
18. Loe H, Schiott C; The effect of mouthrinse and topical application of Chlorhexidine on the development of dentalplaque and gingivitis. J Periodontal Res, 1970;5:79–83.
19. Lindhe J, Hamp SE, Loe H, Schiott CR; Influence of topical applications of Chlorhexidine on chronic gingivitis and gingival wound healing. Scand J Dent Res, 1970;78:471–8.
20. Ernst CP, Prockl K, Willershemsen B; The effectiveness and side effects of 0.1% Chlorhexidine mouthrinse. Quintessence Int, 1998;29:443–8.
21. Francetti L, del Fabbro M, Testori T, Weinstein RL; Chlorhexidine spray versus Chlorhexidine mouthwash in the control of dental plaque after periodontal surgery. J Clin Periodontol, 2000;27:425–30.

22. Grundenmann LJ, Timmerman MF, Ijserman Y, van der Velden U, van der Weijden GA. Reduction of stain, plaque and gingivitis by mouthrinsing with Chlorhexidine and sodium perborate. Ned Tijdschr Tandheelkd. 2002;109:225–9.
23. Leyes Borrajo JL, Garcia VL, Lopez CG, Rodriguez-Nuñez I, Garcia FM, Gallas TM, et al; Efficacy of Chlorhexidine mouthrinses with and without alcohol: A clinical study. J Periodontol, 2002;73:317–21.
24. Rasheed A, Haider M; Antibacterial activity of Camellia sinensis extracts against dental caries. Arch Pharm Res, 1998;21(3):348-52.
25. Matsumoto M, Minami T, Sasaki H, Sobue S, Hamada S, Ooshima T; Inhibitory effects of oolong tea extract on caries-inducing properties of mutans streptococci. Caries Res, 1999;33(6):441-5.
26. Otake S, Makimura M, Kuroki T, Nishihara Y, Hirasawa M; Anticaries effects of polyphenolic compounds from Japanese green tea.Caries Res, 1991;25(6):438-43
27. Blasingame J; Green tea prevents bad breath. 2009 [updated 2009; cited 2012]; Available from: http://althealth.mitrasites.com/green-tea-and-bad-breath.html.
28. Rassameemasmaung S, Phusudsawang P, Sangalungkarn V; Effect of Green Tea Mouthwash on Oral Malodor. ISRN Preventive Medicine, 2013:1-6
29. Moghbel A, Farjzadeh A ,Aghel N ,Agheli H, Raisi N; Evaluation of the Effect of Green Tea Extract on Mouth Bacterial Activity in the Presence of Propylene Glycol. Jundishapur J Nat Pharm Prod, 2012;7(2):56-60.
30. Jenabian N, Moghadamnia A, Karami E and Bejeh M; The effect of Camellia Sinensis (green tea) mouthwash on plaque-induced gingivitis: a single-blinded randomized controlled clinical trial. Daru J Pharm Sci, 2012;20:39