

Comparative evaluation of the anti-plaque efficacy of green tea extract mouthrinse and white tea extract mouthrinse with chlorhexidine gluconate mouthrinse-A clinical and microbiological study

Ayushi Nagar^{1,*}, Anubhuti Tyagi², Swyeta Jain Gupta³, Akanksha Banga⁴, Nikhil Sharma⁵, Amit Gupta⁶

^{1,2}BDS Student, ^{3,4}Senior Lecturer, ⁵HOD, ⁶Reader, ^{1,2,3,5}Dept. of Periodontology and Oral Implantology, ⁴Dept of Oral and Maxillofacial Pathology, ¹⁻⁵I.T.S Centre for Dental Studies and Research, Muradnagar, Ghaziabad, Uttar Pradesh, ⁶I.T.S Dental College, Hospital and Research Centre, Greater Noida, Uttar Pradesh, India

***Corresponding Author:**

Email: ayushinagar.ayu@gmail.com

Abstract

Introduction: Numerous studies have been conducted based on the natural mouthwashes, with fewer side effects, as an alternative to chemical ones. The aim of this study is to compare clinically and microbiologically the anti plaque efficacy of mouthwash containing extract of green tea, white tea extract with chlorhexidine gluconate mouthwash.

Materials and Methods: This clinical study was performed in the department of Periodontology and Oral Implantology, I.T.S Dental College, Muradnagar, Ghaziabad, India. All the patients were educated about the study and then a written informed consent was acquired before enrolment in the study. The study was conducted for a period of 10 days.

A total of 30 Dental students were selected as patients of age group of 19-23 years (from 1st to 2nd year) according to assigned inclusion criteria, oral prophylaxis was performed & the subjects were randomly allocated equally to one of the three treatment groups (10 each) Group A – Green Tea Extract, Group B – White Tea Extract, Group C- Chlorhexidine gluconate. The subjects were assessed both preoperatively and postoperatively clinically by recording the plaque and gingival indices and microbiologically by counting the number of colonies forming units/mL (CFU/mL).

Results: Green Tea showed statistically significant difference in clinical parameters and in CFUs/ml compared to White Tea.

Conclusion: The results of the current study indicated that White Tea and Green Tea mouth rinse were found to be a potent anti-plaque agent although less efficacious than chlorhexidine mouth rinse. Green tea catechin mouthwash was comparably efficacious to chlorhexidine gluconate as an antiplaque agent when used for 10 days.

Keywords: Green tea, White tea, Chlorhexidine gluconate mouth rinse, Antiplaque

Introduction

Oral disease or disease pertaining to mouth are often associated with gum diseases (gingivitis), and periodontitis which is a condition in which supporting structures and bone are destroyed and subsequently teeth would corrupt and exfoliate. One of the leading prevalent cause of periodontal disease is gingivitis mainly induced by plaque affecting 90% of the population, regardless of age, gender, or ethnicity.¹ In more developed countries, the prevalence and the severity of the gingivitis varies in accordance to the age range. The gingivitis' prevalence among juvenile is reported to be 61.5% in USA, 85% in Australia and 95% in India. Dental plaque (bacterial biofilm) on the surface of teeth is accounted as the main cause of gingivitis. However, other factors include systemic disease, hormonal changes, gender, age, economic conditions which may also affect the response of gingival tissue to prevailing dental plaque.² Mechanical cleaning methods have been proven to be the quite effective way for the plaque control and in turn gingivitis. However, since tooth brushing is not adequately and efficiently practiced by majority population, the additional incorporation of chemical agents, such as chlorhexidine and triclosan,³ have emerged as an effective adjunct. A wide array of synthetic mouthwashes are available commercially; but

chlorhexidine, which has been approved by ADA and FDA is regarded as the most effective antibacterial mouthwash. Green tea extract can be used as another herbal mouthwash, however its processing is under investigation. During recent years, the health benefits of green tea have been researched thoroughly, and in recent studies correlation between green tea and reduction of periodontal diseases has been established. Tea is an ancient beverage procured from the leaves *Camellia Sinensis*, a tropical green shrub or small tree. Catechins, the key constituent to tea's health benefits, is credited to its ability to act as antioxidant. When drawing a comparison from black tea, green tea has higher concentration of polyphenol. Catechin suppresses the periodontal inflammation, thereby ensuring better dental and gingival health.⁴ Catechin, an antioxidant compound may also exhibit anti-inflammatory effect. Tea polyphenol prevents the plaque formation over the teeth's enamel surface, thus in turn minimising the risk of dental caries as well. Furthermore, green tea has been found to combat bacterial growth, the fore bearer step of malodour (halitosis). Some varieties also contain fluorides which helps strengthening the teeth. Along with these benefits, it also has ability to reduce gum diseases.

White tea originates from the plant *Cameliasinensis*. White tea has a light taste and color. The origin of white tea is mostly from Fujian Province

of china and is least processed form of tea with least amount of caffeine as compared to black and green tea the ingredients of white tea are alanine, and amino acids. The most important ingredients in white tea are rich in polyphenols, which is natural antioxidant. It has many health benefits, as it can combat bacteria, fungi, and viruses in the body more successfully than other variant.

Materials and Methods

The current clinical trial was double blinded, randomized parallel, longitudinal study. Thirty periodontally healthy subjects between the age group of 19-23 years were enrolled in a 10 day rinsing study. Mouthwashes were labelled as A-Green Tea, B-White Tea and C- 0.2% Chlorhexidine gluconate by the examiner.

Green Tea and White Tea mouthwashes were prepared by boiling 1 mg of green and white tea extract in 10 ml of distilled water for 5 minutes. No preservatives or flavouring agents were added.

Subjects with good systemic health with atleast 24 scorable teeth (not including third molar or crowned teeth) were taken in the study. Subjects having high consumption of polyphenolic diet (including green tea or soya diet), wore appliances, or prostheses (removable or fixed) , those were on prescribed antibiotics and other medication for the previous 3 months or the ones who had undergone treatment for periodontal problems were excluded from the study.

This study was approved by the ethical committee of the same ITS Dental college, Muradnagar, Ghaziabad.

The subjects were randomly assigned into three equal groups A, B and C (10 subjects in each group) At baseline, thorough oral prophylaxis was performed for all the subjects by the investigator. Plaque sample were collected at baseline and 10 days. Subjects were told not to use interdental aids or chewing gums for the next 10 days. Subjects were asked to use one of the assigned mouthwash two times a day at a particular specified time during the day for 1 min with 10 ml of randomly allocated rinse. At each rinsing, 10 ml of the solution was made to swish around the mouth for about 60 sec and then expectorated.

At baseline and 10th day; plaque index (PI) and gingival index (GI) were recorded and subjects were allowed to recommence their routine oral hygiene regimens post 10th day.

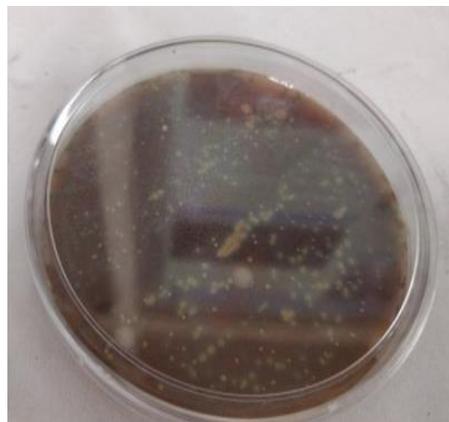


Fig. 1: Colony forming units



Fig. 2: Samples collected



Fig. 3: Plaque index



Fig. 4: Gingival index



Fig. 5: Incubation chamber fig 6 colony counter



Fig. 6: Colony counter

Results

Thirty subjects, 9 males and 21 females comprised of the present study. The results are presented in table 1 and 2. Chlorhexidine showed statistically better result in relation to Plaque Index, Gingival Index and Colony Forming Units as compared to Green Tea and White Tea extract mouthwash. The results demonstrated that the values of PI evaluated were comparable for both Green Tea and White Tea but in respect to GI and CFUs Green Tea extract mouthwash showed statistically significant reduction in scores as compared to White Tea extract mouthwash (Table 1). Difference between the individual mouthwashes were determined through the multiple comparison in Table 2 and further graph was plotted showing the mean pre and post difference between the gingival index, plaque index and CFU for individual mouthwashes. (Fig. 1, 2)

There was no burning sensation or taste alteration reported by any of the participants at the end of the study period. In addition, there was no evidence of gingival epithelial desquamation on intraoral examination in any of the subjects.

Discussion

The present study compared and evaluated the anti plaque effects of the newly formulated white tea mouthwash, green tea mouthwash, and chlorhexidine gluconate mouthwash.

Green tea is a variety of tea derived from *Camellia sinensis*, a topical evergreen shrub, is a potent

antioxidant and has anti-inflammatory properties. Most of the biological properties of green tea have been attributed to the catechin fraction, which possesses certain therapeutic and biological properties, Catechin such as Epigallocatechin-3-gallate (EGCG) is intercalated into phospholipid bilayers and it is thought to effect both virulence and antibiotic resistance. It exerts inhibitory effect on *S.mutans* growth, which are primarily responsible for caries and gingivitis.⁴ Catechins have pronounced role to play on pH value of saliva and dental plaque and keep it preserved to normal range (7.2-7.4) which is not a favourable condition for growth of *S.Mutans*. The mechanism of action of tea's health benefit comes from prevention of oxidation. The concentration of polyphenol is quite high (the major antioxidant in green tea leaves).⁵ Catechins have been found to have antiplaque and antibacterial properties and prevention in gingival enlargement. Hirasawa *et al* demonstrated bactericidal potential of green tea catechins at 1mg/1ml against *Prevotella* and *P. gingivalis* species and observed a significant reduction in cytokine profile markers of gingivitis post using it as a slow-release buccal delivery system applied over a period of 8 weeks.⁶ Green tea catechin also has an interdictory effect on collagenase activity, thus limiting tissue destruction. It has found to minimise matrix metalloproteinase-9 expression in osteoblasts and also inhibits the formation of osteoclasts. Thus, EGCG may prevent alveolar bone resorption that occur in periodontal disease.⁷

White tea consists of mainly fluoride, tannins and flavinoids which is effective in caries reduction and inhibitory effect on the growth of bacteria. White tea mouthrinse was found to be a potent antiplaque agent, though less efficacious than chlorhexidine and green tea mouthrinse. Probably, it can serve as a long term herbal antiplaque agent in maintenance phase or as an alternative for the patients looking for herbal products mouthrinse, or for the patients who complaint of side-effects due to chlorhexidine mouthrinse.

Chlorhexidine gluconate is gold standard against which antiplaque and antigingivitis agents' potential are measured. It comes under second generation Bisbiguanides.

This study hence signifies the efficacy of a green tea catechin mouth wash, white tea extract mouthwash and chlorhexidine gluconate mouthrinse as an antiplaque agent compared over a 10 day period. One shortcoming of this study is the small sample size. However, sufficient sample size was found when power calculations were performed prior to the beginning of the study. More extensive studies using a longer duration span, larger sample size and a cross-over model can be performed for further research.

Conclusion

The results of the current study indicated that White Tea And Green Tea mouth rinse was found to be a

potent anti plaque agent although less efficacious than chlorhexidine mouth rinse. Green tea catechin mouthwash was comparably efficacious to chlorhexidine gluconate as an antiplaque agent when used for 10 days. Furthermore, green tea catechin mouthwash having more palatable taste and no known significant side-effects can be used on a day today basis

as an alternative for chlorhexidine gluconate as an antiplaque agent. It should be further explored and evaluated as a long term antiplaque rinse with prophylactic benefits.

Green Tea and white tea can serve as a good alternative for patients who prefer herbal products which have practically no side effects.

Table 1: Comparison of various clinical parameters and CFU at baseline and 10 days

Clinical Parameter	Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
PI PRE	Chlorhexidine	10	1.58	.365	.115	1.32	1.84
	White tea	10	1.51	.448	.142	1.19	1.83
	Green tea	10	1.55	.354	.112	1.29	1.80
	Total	30	1.55	.379	.069	1.40	1.69
PI POST	Chlorhexidine	10	.6380	.17574	.05557	.5123	.7637
	White tea	10	.7810	.31988	.10115	.5522	1.0098
	Green tea	10	.9710	.32760	.10360	.7366	1.2054
	Total	30	.7967	.30642	.05594	.6822	.9111
GI PRE	Chlorhexidine	10	1.5970	.17525	.05542	1.4716	1.7224
	White tea	10	1.3560	.17946	.05675	1.2276	1.4844
	Green tea	10	1.4490	.25623	.08103	1.2657	1.6323
	Total	30	1.4673	.22381	.04086	1.3838	1.5509
GI POST	Chlorhexidine	10	.5630	.13889	.04392	.4636	.6624
	White tea	10	.7590	.13755	.04350	.6606	.8574
	Green tea	10	.6590	.15249	.04822	.5499	.7681
	Total	30	.6603	.16031	.02927	.6005	.7202
CFU PRE	Chlorhexidine	10	115.70	16.255	5.140	104.07	127.33
	White tea	10	113.00	18.172	5.746	100.00	126.00
	Green tea	10	110.80	11.153	3.527	102.82	118.78
	Total	30	113.17	15.075	2.752	107.54	118.80
CFU POST	Chlorhexidine	10	69.60	11.946	3.778	61.05	78.15
	White tea	10	90.80	10.768	3.405	83.10	98.50
	Green tea	10	72.60	9.594	3.034	65.74	79.46
	Total	30	77.67	14.128	2.579	72.39	82.94

Table 2: Multiple comparisons between various mouthwashes

Dependent Variable	Group	Group	Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PI PRE	Chlorhexidine	White tea	.071	.175	.914	-.36	.50
		Green tea	.032	.175	.982	-.40	.47
	White tea	Chlorhexidine	-.071	.175	.914	-.50	.36
		Green tea	-.039	.175	.973	-.47	.39
	Green tea	Chlorhexidine	-.032	.175	.982	-.47	.40
		White tea	.039	.175	.973	-.39	.47
PI POST	Chlorhexidine	White tea	-.14300	.12663	.505	-.4570	.1710
		Green tea	-.33300*	.12663	.036	-.6470	-.0190
	White tea	Chlorhexidine	.14300	.12663	.505	-.1710	.4570
		Green tea	-.19000	.12663	.307	-.5040	.1240
	Green tea	Chlorhexidine	.33300*	.12663	.036	.0190	.6470
		White tea	.19000	.12663	.307	-.1240	.5040
GI PRE	Chlorhexidine	White tea	.24100*	.09258	.038	.0115	.4705
		Green tea	.14800	.09258	.264	-.0815	.3775

	White tea	Chlorhexidine	-.24100*	.09258	.038	-.4705	-.0115	
		Green tea	-.09300	.09258	.580	-.3225	.1365	
	Green tea	Chlorhexidine	-.14800	.09258	.264	-.3775	.0815	
		White tea	.09300	.09258	.580	-.1365	.3225	
	GI POST	Chlorhexidine	White tea	-.19600*	.06401	.013	-.3547	-.0373
			Green tea	-.09600	.06401	.307	-.2547	.0627
White tea		Chlorhexidine	.19600*	.06401	.013	.0373	.3547	
		Green tea	.10000	.06401	.279	-.0587	.2587	
Green tea		Chlorhexidine	.09600	.06401	.307	-.0627	.2547	
		White tea	-.10000	.06401	.279	-.2587	.0587	
CFU PRE	Chlorhexidine	White tea	2.700	6.923	.920	-14.46	19.86	
		Green tea	4.900	6.923	.761	-12.26	22.06	
	White tea	Chlorhexidine	-2.700	6.923	.920	-19.86	14.46	
		Green tea	2.200	6.923	.946	-14.96	19.36	
	Green tea	Chlorhexidine	-4.900	6.923	.761	-22.06	12.26	
		White tea	-2.200	6.923	.946	-19.36	14.96	
CFU POST	Chlorhexidine	White tea	-21.200*	4.835	.000	-33.19	-9.21	
		Green tea	-3.000	4.835	.810	-14.99	8.99	
	White tea	Chlorhexidine	21.200*	4.835	.000	9.21	33.19	
		Green tea	18.200*	4.835	.002	6.21	30.19	
	Green tea	Chlorhexidine	3.000	4.835	.810	-8.99	14.99	
		White tea	-18.200*	4.835	.002	-30.19	-6.21	

*. The mean difference is significant at the 0.05 level.

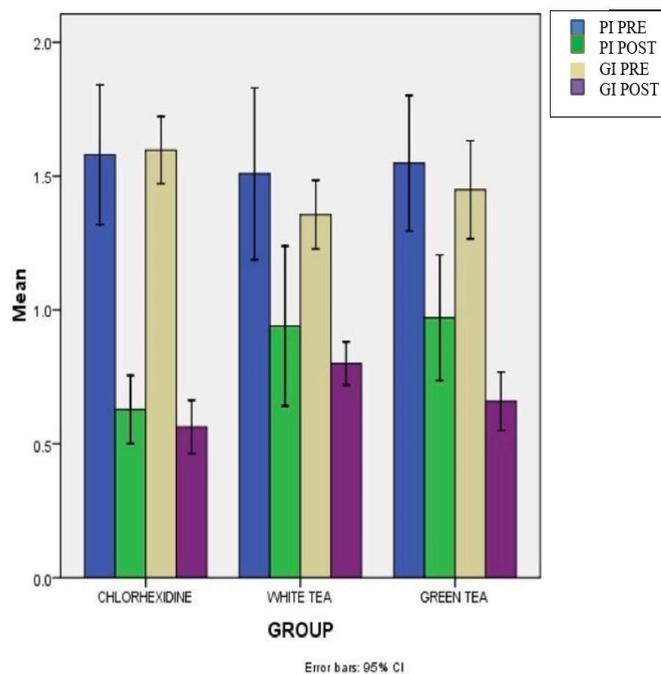


Fig. 1: Comparison of various clinical parameters at various time intervals

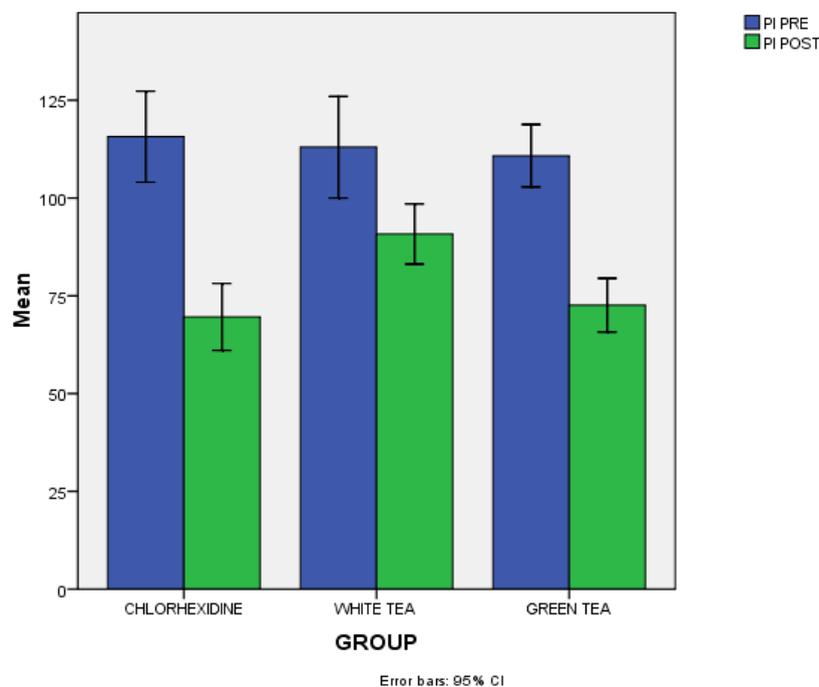


Fig. 2: Comparison of CFU in 3 groups

Conflict of Interest: None.

Reference

1. de Oliveira SM, Torres TC, Pereira SL, Mota OM, Carlos MX. Effect of adentifrice containing Aloe vera on plaque and gingivitis control. A double-blind clinical study in humans. *J Appl Oral Sci* 2008;16(4):293-96.
2. Ketabi M, Tazhibi M, Mohebrasool S. The prevalence and risk factors of gingivitis among children referred to Islamic Azad University (Khorasgan Branch) Dental School, in Iran. *Dent Res J* 2006;3(1):1-3
3. Hirasawa K, Takada S, Otake. Inhibition of acid production in dental plaque bacteria by green tea catechins. *Caries Res* 2006;40(3):265-70
4. Soukoulis S, Hirsch R The effect of tea tree oil containing gel on plaque and chronic gingivitis. *Aust Dent J* 2004;49(2):78-83
5. Lorenzo JM, Munekata SEP. Phenolic compounds of green tea: Health benefits and technological application in food. *APJTB* 2016;6(8):709-19
6. Hirasawa M, Tahada K, Makimura M, Otake S. Improvement of periodontal status by green tea catechin using a local delivery system: a clinical pilot study. *J Periodontal Res* 2002;37(6):433-38.
7. Zhen MC, Huang XH, Wang Q, Sun K, Liu YJ, Li W, et al. Green tea polyphenol epigallocatechin-3-gallate suppresses rat hepatic stellate cell invasion by inhibition of MMP-2 expression and its activation. *Acta Pharmacol Sin* 2006;27(12):1600-7

How to cite the article: Nagar A, Tyagi A, Gupta SJ, Banga A, Sharma N, Gupta A. Comparative evaluation of the anti-plaque efficacy of green tea extract mouthrinse and white tea extract mouthrinse with chlorhexidine gluconate mouthrinse-A clinical and microbiological study. *J Dent Specialities* 2018;6(2):109-114.