

Effect of green tea mouthwash on reducing plaque and gingivitis

Abstract

Background and objective: Extensive studies have been made on the natural mouthwashes, with fewer side effects, as an alternative to chemical ones. The present study aimed to determine the efficacy of green tea and chlorhexidine mouthwashes on plaque and gingival indices.

Materials and Methods: The present was a double-blind clinical trial (intervention study). A total of 10 dental students as patients (from first to fourth semester) at Shahid Beheshti Dental School were selected according to the inclusion criteria. Plaque and gingival indices were evaluated. The subjects were allocated to use placebo, green tea and chlorhexidine mouthwashes for three courses of three days. There was one week interval between each course. Scaling and root planing were performed for all the patients. After each course, the desired parameters were calculated and data analyzed by nonparametric statistics (e.g., Kruskal-Wallis test, Mann-Whitney U test, Wilcoxon, using repeated measures).

Results: at baseline and three days after the usage, the mean plaque index was 2.2 and 1 in the green tea group, 2 and 2.5 in the placebo group, and 2 and 0.88 in the chlorhexidine group, respectively. Reductions in gingival index (GI) ranged from 1.1 to 0.6 in the green tea group, from 1.1 to 2.1 in the placebo group and 1.0 to 0.75 in chlorhexidine group, respectively. It was found that green tea mouthwash could significantly reduce the plaque index as well as gingivitis. There was no significant difference between chlorhexidine and green tea mouthwashes in reducing gingivitis. However, the use of chlorhexidine found to reduce plaque level more than the use of green tea mouthwash. Furthermore, in some of the subjects using chlorhexidine mouthwash, tooth staining (dental calculus) observed.

Conclusion: chlorhexidine and green tea mouthwashes found to be effective in reducing plaque index, and it has been shown to be equally effective in gingivitis reduction. However, the green tea and chlorhexidine mouthwashes were more effective than placebo. Concerning gingival and plaque indices, the green tea and chlorhexidine mouthwashes were minimally effective after 72h and 24h respectively.

Keywords: mouthwash, green tea, chlorhexidine, plaque index, gingival index, gingivitis, tooth staining (dental calculus)

Volume 9 Issue 2 - 2018

Elham Romoozi, Reza Bekhradi, Mohammad Reza Talebi, Parisa Barouti, Elahe Kamali
Kashan University of Medical Sciences, Iran

Correspondence: Parisa Barouti, Kashan University of Medical Sciences, Iran, Email p.barouti@yahoo.com

Received: December 19, 2017 | **Published:** April 26, 2018

Introduction

Stomatognathic diseases or mouth diseases are often associated with gingivitis (inflammation of the gingival tissues), a condition in which gingival and bone tissues are destroyed and consequently teeth would corrupt. One of the most prevalent periodontal diseases is plaque-induced gingivitis affecting 90% of the population, regardless of age, sex or race.¹ In developed countries, the prevalence and severity of gingivitis varies according to the age range. The prevalence of gingivitis in children reported from 61.5% in USA, to 85% in Australia and 95% in India. Dental plaque (bacterial biofilms) on the surfaces of teeth is the major cause of gingivitis. However, other factors such as systematic diseases, hormonal changes, sex, age, economic conditions may also influence the response of gingival tissues to dental plaque.² Mechanical cleaning methods have been found the most effective way for the control of plaque and gingivitis. However, since toothbrushing is not adequately practiced by people, the use of chemical agents, such as chlorhexidine and triclosan, emerged as an effective adjunct.² A wide variety of synthetic mouthwashes are available in market;

but chlorhexidine has been approved by the FDA and ADA as the most potent antibacterial mouthwash. Addy³ found that chlorhexidine has more effective anti-plaque properties than triclosan.³ Killoy⁴ conducted a research to measure the release rate of chlorhexidine (PerioChip). He found out firstly it is released at an effective and constant rate over a period of 7 days and gradually biodegrades through enzymatic action; and secondly, it can reduce bacteria count that this property lasts for up to 100 days; last but not least, it is more effective than mere scaling.⁴ Using green tea mouthwash, with comparable bactericidal activity to that of chlorhexidine, is more safe and cost effective.⁵ Matrica is one of the domestic herbal mouthwashes, a product made by Barij Essence pharmaceutical company. It is also used in Germany and the prescription for oral diseases and skin conditions is officially approved.⁶ Alali⁷ suggested Persica leaves have strong bactericidal properties that target many types of oral bacteria and are similar to antiseptics. The effect of Persica on gingivitis and pocket depth (PD) is approved in domestic studies, on the other hand, chlorhexidine considered more effective in improving pocket depth.⁷ Green tea mouthwash is another herbal

mouthwash, which its production is under investigation. During recent years, the health benefits of green tea have been extensively researched, and in recent studies a correlation between intaking green tea and reducing teeth and periodontal diseases is discovered. Tea is an ancient beverage made from the leaves of *Camellia Sinensis*, a tropical evergreen shrub or small tree. During producing the harvested green tea leaves, Catechin, the key to tea's health benefits, should be precluded from oxidation. Compared to black tea, green tea has the higher concentration of polyphenol (the most important antioxidant in green tea leaves) and thus more therapeutic benefits.⁸ Researchers believe that the association between intaking green tea and maintenance of the oral health may result from green tea catechins.^{9,10} Catechin suppresses periodontal inflammation, thereby providing better dental and gingival health.¹¹ Catechin, an antioxidant compound may also exert anti-inflammatory effect.⁵ Tea polyphenols prevent the plaque from sticking to the teeth's enamel, thus reducing the risk of dental caries. Furthermore, green tea inhibits bacterial growth, the precursor of oral malodor (halitosis). Some kinds of green tea contain fluoride which helps strengthen the teeth.⁴ Green tea's ability to help reduce gum diseases is attributed to the presence of the antioxidant.¹² Owing to availability of a wide range of herbal mouthwashes in Iran and extensive advertising and increasing tendency towards herbal products, it seems reasonable to perform laboratory tests and clinical trials to ascertain the effects and types of these mouthwashes. Although little research has been done internationally to compare the herbal and chlorhexidine mouthwashes, their results and even domestic reports have demonstrated that chlorhexidine has priority over other mouthwashes. In the present study, in order to evaluate changes in form of probing pocket depth and gingivitis, the efficacy of green tea mouthwash and chlorhexidine 0.2% along with patients in phase 1 treatment were compared, according to plaque and gingival indices. The probable side effects of these mouthwashes were also investigated.

Materials and methods

The present study is a clinical trial (intervention study) including ten dental students of Shahid Beheshti University of Medical Sciences. The inclusion criteria were as follows:

No systemic disease over six months ago, not taking medications including antibiotics during the last six months, no periodontal disease during the last six months. The age and sex of the subjects were compared. The bottles containing chlorhexidine, green tea and placebo were identical and the samples were systematic (bottle A, green tea; bottle B, placebo; bottle C, chlorhexidine). Meanwhile, subjects and examiner were blind to allocation, i.e. the type of mouthwash. For this purpose, ten patients were selected from the dental students of Shahid Beheshti University. First, a questionnaire meeting the inclusion criteria given to 40 dental students of Dental School of Shahid Beheshti University and then ten out of them were selected according to the desired criteria. After selecting and justifying samples, first, PI and GI (by Sillness & LEO method) were measured, and then, scaling and root planing were performed. Patients were provided with sufficient oral and written explanations and informed consents prepared by the Research Center of Dental School of Shahid Beheshti University were obtained from all of them. The patients were asked to refrain from all oral hygiene procedures for three days and only use mouthwash. In the first course of this experiment, the subjects were instructed to rinse for 1 min four times daily with green tea, before each meal and before sleeping at night. Then clinical measures

including PI and GI were taken 24 and 72 hours post-rinsing. After one week interval, second course was started. In the examination session of this course, as the previous one, GI and PI of the patients were measured and then scaling and root planing were done for all of them. The rest was done as the first course, except that this time they were given placebo, rather than the green tea. Finally, after one week interval, the third course began with using chlorhexidine, but the patients were instructed to rinse for 1 min twice daily, morning and night. The specified groups did not have dietary restrictions except for coffee and tea. Then, a questionnaire consisting of patients' personal information and the specified indices were recorded by the same examiner (the research assistant). The desired parameters analyzed for each patient in the study included plaque index (PI) and gingival index (GI). Two patients, due to drinking tea and coffee during the course of the study, and the other two, because of chlorhexidine intolerance, were excluded from the study.

Subsequently, the total number of digits was divided by 4 and according to the index the results are as follows:

Zero= the obtained number between 0-1, one= the obtained number between 1-3, two=the obtained number between 3-4 and three= the obtained number greater than 4. Formation of dental calculus was recorded during the observation period. Then, the mean and standard deviation of plaque index were calculated. Friedman test was applied to evaluate and compare prevention measures in each session, and the Wilcoxon signed rank test was used for paired comparisons. Moreover, analyzing repeated measures was performed for multivariate analysis. Type I error in this study was considered at 0.05. Thus P values less than 0.05 interpreted as being statistically significant.

Results

The study sample comprised 10 subjects (6 men and 4 women) with an age range between 18-22 years. The subjects used the specified mouthwash (green tea, placebo and chlorhexidine) in three courses as prescribed. The plaque index in the green tea group was 2.2 prior to treatment, 1 after three days treatment; indicating a significant difference compared with the placebo group ($p < 0.001$). However, no significant difference was found ($p = 0.87$) when compared with chlorhexidine group. Mean plaque index in chlorhexidine group was 2 at baseline, 1.63 after 24 hours and 0.88 after 72 hours. These changes were significant using the Wilcoxon signed rank test ($p < 0.05$). Mean plaque index in the placebo group was 2 at baseline, 2.1 after 2 hours and 2.5 after 72 hours. As it was mentioned before, plaque index in both green tea and chlorhexidine groups (without considering age and sex) reduced drastically, although it was decreased more in chlorhexidine group compared with the green tea group ($p < 0.05$). No significant differences observed in the two groups in terms of age or gender ($p > 0.1$) (Table 1). According to the table above, regarding plaque and gingival indices, no significant correlation was found between the extreme scores and the groups participating in the study ($p > 0.3$) (Table 2).

The reduction trend in scores observed in green tea group in terms of plaque index which is statistically significant ($p < 0.001$) The same result obtained in chlorhexidine group, whereas no significant difference found in the placebo group ($p = 0.076$) The green tea showed a significant decrease in gingival index score while placebo showed a large increase. However, the effect of chlorhexidine was not significant ($p > 0.05$). The results of repeated measures analysis exhibited the effect of the treatment groups on PI ($p = 0.025$). By

carrying out the post-hoc test, showing the differences between the analysis results on GI, the effect of the treatment groups on GI was also indicated. However, after repeating the post-hoc test, a significant difference was observed between the placebo group and the other groups ($p < 0.05$)

Table 1 Frequency distribution for scores in each group at baseline

Index	Groups	Green tea	Placebo	Chlorhexidine	(P.value)
		1	2	3	
plaque index	1	10	20	30	0.518
	2	6	6	4	
	3	30	60	40	
	1	3	2	3	
	2	9	20	30	
	3	30	20	30	
Gingival index	1	9	9	10	0.378
	2	90	90	100	
	1	1	1	—	
	2	10	10		

Discussion

In this study, the mean plaque index significantly reduced after 24 and 72 hours ($p < 0.01$) for the green tea and chlorhexidine groups, while in placebo group, plaque and Gingival indices increased during different times. The mean gingival index in the green tea group significantly reduced 72 hours postrinsing ($p = 0.018$), whereas, no

significant decrease was found in chlorhexidine and placebo groups ($p > 0.05$). Morang⁹ found the chlorhexidine more effective in reducing bacterial plaque than sanguinarine mouthwash. Seyedin (1996) also reported chlorhexidine 2.5 times more effective in reducing plaque accumulation when compared to Persika. Therefore, chlorhexidine is still considered the standard mouthwash.⁹ The findings of the study by Otogoto et al.¹³ showed that green tea extract at concentrations of 0.05% (0.5 milligrams per liter) with 0.2% ethanol decreased dental plaque formation by 40%.¹³ Hirasawa M et al.⁸ found that compounds present in green tea are effective in reduction of dental plaque and microorganisms including *Streptococcus mutans*.⁸ In the present study, both green tea and chlorhexidine mouthwashes were found to be significantly effective in terms of dental plaque and gingival indices after 24 and 72 hours respectively ($p < 0.05$) (Figure 1). According to one study, 1.2 days was the length of stay in hospitals for treatment of gingivitis. Ooshima T et al.¹⁰ demonstrated a significant difference between placebo and green tea groups on reducing plaque, and they also found plaque formation on tooth was reduced by 52% in the green tea group. This finding is consistent with results of the current study.¹⁰ A significant difference was observed in the incidence of gingivitis between the green tea and placebo groups ($p < 0.05$), whereas no significant difference was found between green tea and chlorhexidine groups ($p > 0.05$), and both mouthwashes were found to be equally effective (Table 2). One of the expected results in this study was the incidence staining of teeth, restricting chlorhexidine application, despite its suitable bactericidal properties. Some individuals cannot endure using chlorhexidine long term Owing to unpleasant taste and subsequently two subjects were dropped out of treatment. Due to the short-time trail period (one month), it was not feasible to compare changes in taste perception related to the use of green tea and chlorhexidine mouthwash. Nevertheless patients made no complaint about the adverse event.

Table 2 Statistical indices of GI and PI in different courses of study among the three groups

Index	Groups	Time		24hours		72hours		
		At beginning of research	Mean	S.D± \bar{x}	Mean	S.D± \bar{x}	Mean	
plaque index	green tea	6/0±2/2	2	5/0±5/1	5/1	67/0±1	1	001/0>
	Placebo	67/0±2	2	57/0±1/2	2	5/0±5/2	5/2	076/0
	chlorhexidine	82/0±2	2	52/0±6/1	2	84/0±88/0	1	001/0
Gingival index	green tea	3/0±1/1	1	3/0±1/1	1	5/0±6/0	1	018/0
	Placebo	3/0±1/1	1	3/0±1/1	1	3/0±1/2	2	001/0>
	chlorhexidine	0/0±1	1	0/0±1	1	46/0±75/0	1	135/0

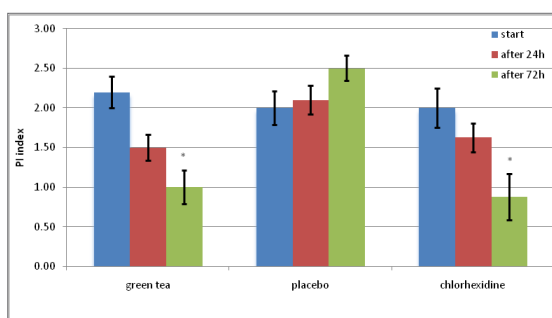


Figure 1 Mean (95% confidence interval) plaque index in different treatment groups, in different times.

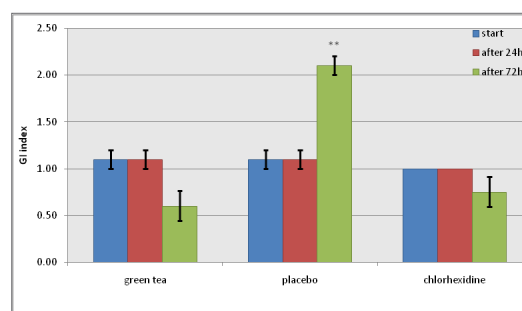


Figure 2 Mean (95% confidence interval) gingival indexes in different treatment groups, through different times.

Conclusion

1. Both mouthwashes showed beneficial effect on improving and treating dental plaque as well as reducing the occurrence of gingivitis.
2. Green tea mouthwash was found to be more effective in reducing gingival index than chlorhexidine.
3. Green tea and chlorhexidine showed comparable effectiveness on gingivitis reduction.

Acknowledgements

The present project was the number 6360 research plan, approved by Research Center for Dental Sciences of Dental School of Shahid Beheshti University. Hereby profound appreciation is expressed to Dr. Safavi, chairman of the Research Centre.

Conflict of interest

The author declares that there is no conflict of interest.

References

1. De Oliveira SM1, Torres TC, Pereira SL, et al. Effect of a dentifrice containing aloe vera on plaque and gingivitis control. a double-blind clinical study in humans. *J Appl Oral Sci.* 2008;16(4):293–6.
2. Ketabi M, Tazhibi M, Mohebrasool S. The Prevalance and Risk Factors of Gingivitis Among the Children Referred to Isfahan Islamic Azad University (Khorasgan Branch) Dental School, In Iran. *Dental Research Journal.* 2006;3(1):1–3.
3. Addy M, Morang J, Newcombe R, et al. The comparison between phenolic, chlrohexitidine and anti-adhesive mouth rinse. *J Clin Periodontal.* 1995;22(12):923–928.
4. Killoy W. The use of locally-derived chlrohexitidine in the treatment of periodontitis: Clinical results. *J Clin Periodontal.* 1998;25(11pt2):953–958.
5. Abdolhossein Moghbel, Ahmad Farajzadeh, Nasrin Aghel, et al. Formulation and evaluation of green tea mouthwash: A new, safe and nontoxic product for children and pregnant women. *Abstracts/Toxicology Letters.* 2009;189(Suppl 13):S257.
6. Iranian association of producers of herbal medicines & products. Iranian Licensed herbal medicines. 2nd ed. Prohan publication. 2009:176.
7. Alali F, Al-lofit. GC-MS Analysis and bioactivity testing of the volatile oil from the leaves of tooth brush tree salvadora persica L. *Nat Prod Res.* 2003;17(3):189–94.
8. Hirasawa K, Takada S, Otake. Inhibition of acid production in dental plaque bacteria by green tea catechins. *Caries Res.* 2006;40(3):265–270.
9. Morang J, Addy M, Newcombe R. A clinical trial to assess the efficacy of canguinarin –zinc mouthrinse(Veudent) comporal a chlorohexitidine mouthwash. *J Clin Periodontal.* 1988;15(10):612–6.
10. Ooshima T, Minami T, Aono W, et al. Reduction of dental plaque deposition in humans by oolong tea extract. *Caries Res.* 1994;28(3):146–149.
11. 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.
12. Sakanaka S, Shimura N, Aizawa M, et al. Preventive effect of green tea polyphenols against dental caries in conventional rats. *Biosci Biotechnol Biochem.* 1992;56(4):592–594.
13. Otogoto J, Sato SH, Igarashi T, et al. Effect of an oral rinse extracted from green tea on plaque formation, gingivitis and halitosis. 2007:676–684.
14. www.wrongdiagnosis.com/g/gingivitis/hospital.htm