

COMPARATIVE EVALUATION OF THE ANTI-PLAQUE AND ANTI-INFLAMMATORY EFFECT OF 0.5% GREEN TEA EXTRACT MOUTHWASH WITH 0.2% CHLORHEXIDINE GLUCONATE MOUTHWASH IN PATIENTS UNDERGOING FIXED ORTHODONTIC TREATMENT: A CROSS-OVER STUDY**Dr. Neha Kawale^{1*}, Dr. Varsha Rathod² and Dr. Anupa Shetty³**¹Pg Student, ²Head of Department of Periodontics, ³Assistant Professor,
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ABSTRACT

Aim: Study is to compare the anti-plaque and anti-inflammatory effect of 0.5% Green Tea Extract mouthwash with 0.2% Chlorhexidine Gluconate mouthwash in patients undergoing fixed orthodontic treatment. **Method:** Randomised controlled trial was performed. 6 Subjects were selected divided into two groups group 1 was given green tea mouthwash and group 2 chlorhexidine after 15 day subjects were recalled and checked for Clinical parameters. A washout period of 15 days was kept and on 30th day group were cross overed so group 1 was given chlorhexidine and group 2 green tea mouthwash and on 45 day clinical parameters were checked. **Results:** Green tea mouthwash showed significant difference in terms of plaque reduction and gingival inflammation reduction from baseline to 45th day. **Conclusion:** Green tea mouthwash showed similar efficacy as chlorhexidine in terms of reduction of gingival inflammation and reduction of plaque without any side effects and hence can be used as an alternative to chlorhexidine.

KEYWORDS: Green tea extract mouthwash, orthodontic, chlorhexidine, Fixed appliance.**INTRODUCTION**

Dental plaque is the major etiologic factor for the initiation of gingivitis. Gingival disease can progress to periodontitis when left untreated that eventually compromise the entire periodontium.^[1] Mechanical plaque control remains the gold standard of periodontal therapy. However chemotherapeutic agents are also necessary to be used as an adjunct to control the progression of gingival diseases^[2] as the bacteria present in the soft tissues can re-colonize on the tooth surfaces even after mechanical plaque control.^[3,33]

Chlorhexidine gluconate gives a superior antiplaque effect and it has substantivity for a period of 12 hrs.^[4] In spite of potent antimicrobial and anti-plaque properties of chlorhexidine, its widespread and prolonged use is limited due to its local side effects.^[5] There are a huge number of chemical plaque control agents emerging in the market focusing on the reduction of plaque and gingival inflammation.

Tea catechins, especially EGCG, appear to have antiobesity and antidiabetic effect.^[6] Studies have shown that green tea polyphenols inhibit the growth of oral and periodontopathic bacteria thereby preventing gingivitis and periodontitis.^[33] Green tea is made solely with the leaves of *C. sinensis* that have undergone minimal

oxidation during processing and hence it has more antioxidant and antibacterial properties.^[7,33]

The most abundant components in green tea are polyphenols, in particular, flavonoids such as the catechins. Major catechins found in green tea are epicatechin gallate (ECG), epicatechin (EC), epigallocatechin (EGC), and EGC gallate (EGCG). The beneficial effects of the natural products along with the lower prevalence of side effects could enhance patient compliance and its long-term usage.^[33]

Green tea catechins and polyphenols in green tea were found to have a positive influence on the inflammatory reaction of periodontal structures.^[34,8] Green and black tea were reported to prevent gathering of bacteria and thereby preventing plaque formation compared to Chlorhexidine.^[20,33]

While the biological activities of green tea have been well documented^[9], not much research has been cited regarding its use as an anti-plaque agent and its comparative efficacy with chlorhexidine gluconate.

Fixed Orthodontic appliances increases dental plaque retention and makes tooth brushing and oral hygiene maintenance much more difficult.^[10]

In patients with fixed orthodontic appliance, the presence of malocclusion and crowding makes oral hygiene difficult leading to accumulation of dental plaque. The presence of brackets, elastics, wires and other parts of the orthodontic appliances in the mouth causes change in the salivary pH and bacterial flora of the mouth and ultimately causes plaque accumulation on teeth which is difficult to clean.^[11] Although orthodontic treatment has several positive outcomes, it is imperative for patients undergoing treatment to be extra cautious of their oral hygiene maintenance.^[35]

Hence, in this study Green tea, a natural product with anti-inflammatory and antimicrobial properties was used as mouthwash to control the accumulation of dental plaque in patients undergoing fixed orthodontic treatment and to compare the anti-plaque and anti-inflammatory effect of 0.5% Green Tea Extract mouthwash with 0.2% Chlorhexidine Gluconate mouthwash in patients undergoing fixed orthodontic treatment.

METHOD

A randomized, double blinded, cross over study with a control group was conducted at the Department of Periodontics in Bharati Vidyapeeth Dental College and Hospital. The study was conducted for a period of 45 days between July 2019 and September 2020. The study was approved by the institutional review board of Bharati Vidyapeeth Dental College and Hospital and the permission to conduct it was obtained from institutional Ethical Committee of Bharati Vidyapeeth Dental College and Hospital. The study had designated inclusion and exclusion criteria to minimize sampling bias.

Inclusion criteria

Subjects undergoing fixed orthodontic treatment with metal braces, Subjects aged 15 years and above of either sex, In terms of oral hygiene, subjects who brushed their teeth at least once daily and those who had mild to moderate gingivitis and Subjects who were willing to give written informed consent were included in the study.

Exclusion criteria

Subjects suffering from systemic disease, History of smoking, Subjects undergone antibiotic therapy in the past 3 months, Subjects who had undergone oral prophylaxis in the last three months prior to the study, Subjects not willing to comply with the study protocol were excluded from the study.

Study population and randomization

A total of 6 patients gave consent to participate in the survey for a period of 45 days from July 2019 to September 2020. All the patients undergoing fixed appliance therapy visiting the out-patient of orthodontics department were screened. Considering the criteria for selection, a total of 10 patients were selected. Out of 10, only 6 patients were eligible to participate in the study, and an informed consent was obtained from them. The study population was randomly divided into two groups of group 1 and group 2 respectively (Figure 1). Subjects under Group 1 were given Green tea mouthwash, group 2 was given Chlorhexidine mouthwash (Figure 1). All the subjects were given adequate oral hygiene instructions like brushing at least twice daily and mouthwash should be used daily. All the subjects were advised to take 10ml of mouthwash with same amount of water dilution.

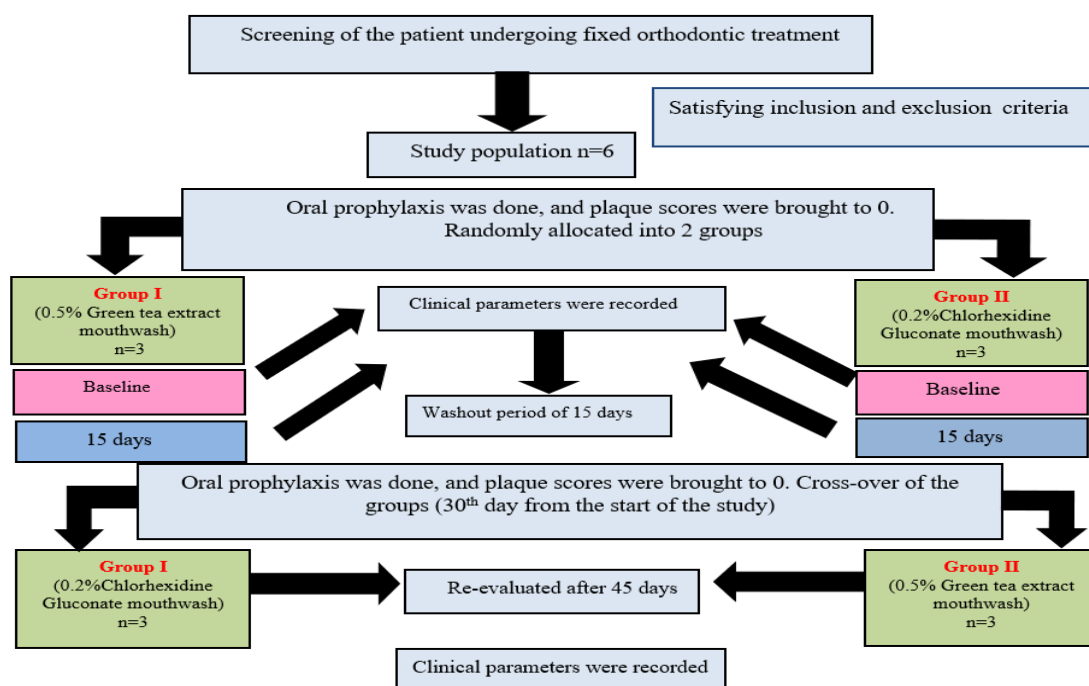


Figure 1.

Clinical examination

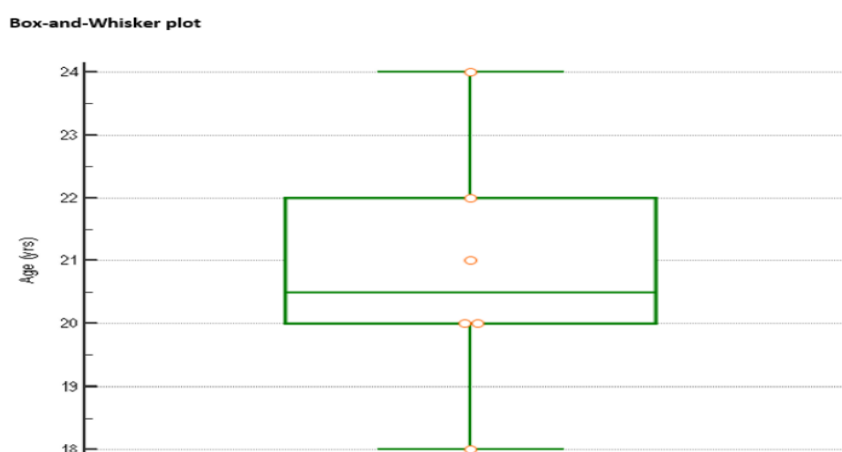
Two indices such as sulcus bleeding index and Turesky gilmore-glickman modification of quigley hein index were recorded for each patient. A single examiner examined all the subjects throughout the study to avoid observer bias. The indices were recorded at 2 intervals such as at baseline and after 15 days. Then a relapse period of 15 days was given to all patients. On 31st day the subjects reported back again to the department. Subsequently, group 1 and group 2 were crossed-over, that is group 1 was given Chlorhexidine mouthwash and Green tea mouthwash was given to subjects under group 2. Indices were subsequently recorded and the subjects were asked to report on 45th for a review (Figure 1).

Data analysis

Paired t-test was used to assess the significance of changes within each group at baseline and review. Critical p-values of significance were set at 0.05 and a confidence of 95%.

RESULTS

After statistical analysis, the following results were obtained: Demographic analysis showed the mean age of the participants in both groups were between 18 to 24 years as shown in Figure 1.



Graph 1: Box -and -Whisker plot showing age (Year) of both groups

Gender distribution was found to be equal in both the groups. A total of 6 participants were included which consisted 2 males and 4 females, as shown in Table 1.

Each group consisted of 3 participants with 1 male and 2 females each.

Sex	No of Subjects	Age in %
Male	2	33.3%
Female	4	66.7%
Total	6	100.0%

Table 3: Frequency table showing number of subjects

At baseline, the mean plaque index scores were found to be 0.997 ± 0.209 and 1.104 ± 0.179 in Group I (green tea group) and Group II (Chlorhexidine group) respectively. After 15 days, the values were found to have reduced in both group 0.853 ± 0.293 and 0.853 ± 0.238 in Group I (0.5% Green tea mouthwash) and Group II (0.2 % Chlorhexidine mouthwash) respectively. Crossing over was done at 30th day following a washout period of 15 days. After 45 days, the final plaque index values were found to be 0.758 ± 0.110 and 0.740 ± 0.240 in the Group I (0.2% Chlorhexidine) and Group II (0.5% Green tea)

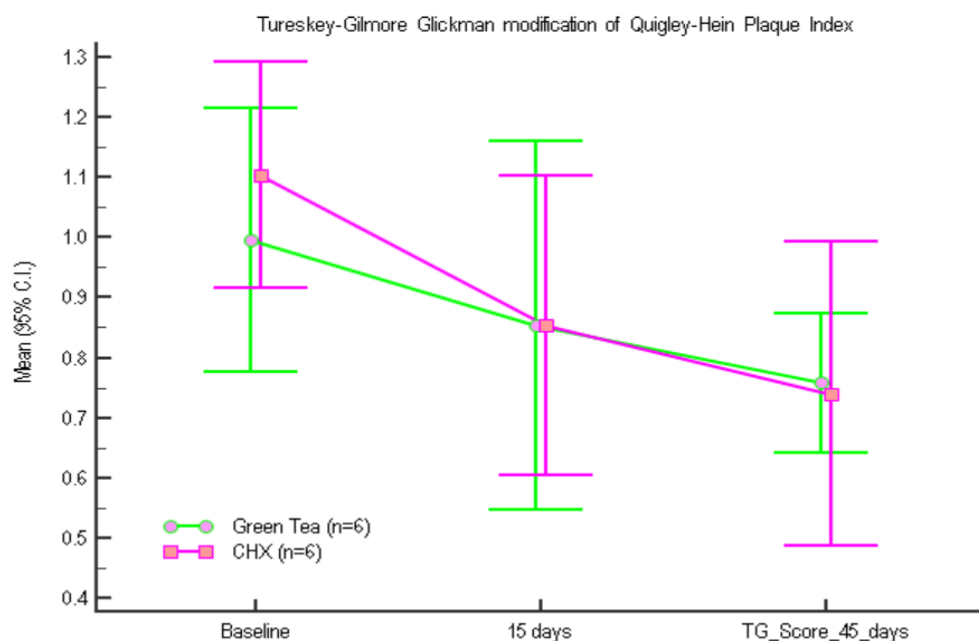
respectively. (Table 4 and graph 2) Table 4 and 5 illustrate the mean plaque score of collective data from Group 1 and Group 2 at baseline, after 15 days and after 45 days. This indicated a change of -0.144 ± 0.249 and -0.239 ± 0.186 from baseline to 15th days and 45th day respectively in the 0.5% green tea mouthwash group. A change of -0.251 ± 0.228 and -0.364 ± 0.277 from baseline to 15th days and 45th day respectively, was noted in the 0.2% Chlorhexidine mouthwash group. (Table 5 and Graph 3) Paired t test for inter group comparison showed no significant difference between the two groups at

baseline, 15 days and 45 days. However, on intra group comparison there was a significant difference at 15th day noted in the 0.2% Chlorhexidine mouthwash group ($p=0.043$); and at the end of 45 days both 0.5% green tea

mouthwash group ($p=0.025$) and 0.2% Chlorhexidine mouthwash group ($p=0.023$) showed statistically significant difference as compared to the baseline.

	Green Tea (n=6)			CHX (n=6)			Un-Paired t-test	p
	Mean	SD	SEM	Mean	SD	SEM		
Baseline	0.997	0.209	0.085	1.104	0.179	0.073		0.363
15 days	0.853	0.293	0.119	0.853	0.238	0.097		0.999
45 days	0.758	0.110	0.045	0.740	0.240	0.098		0.869
Within group comparisons								
	p							
Baseline Vs Day 15	0.217			0.043				
Baseline Vs Day 45	0.025			0.023				

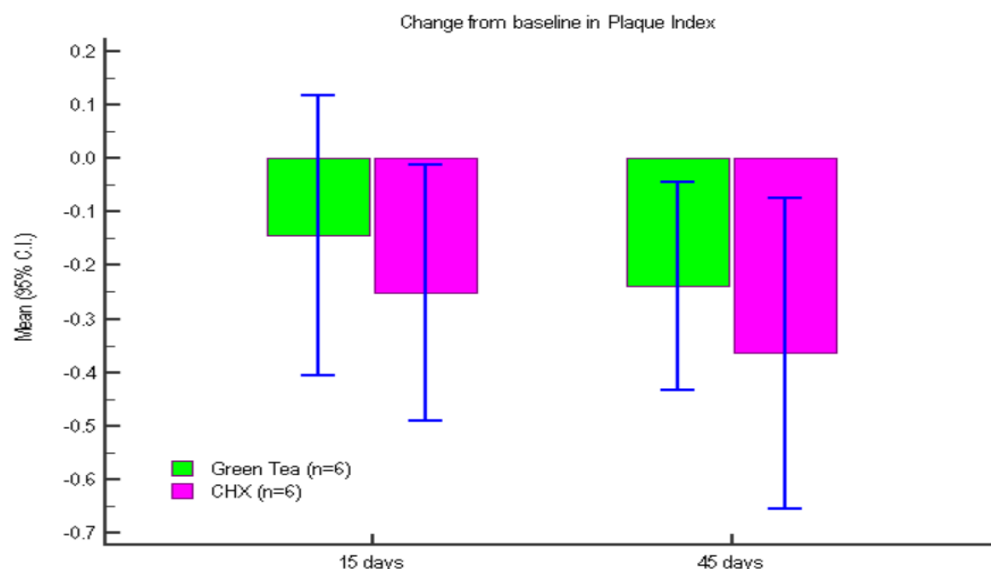
Table 4: Comparison of the mean plaque score of collective data Group 1 and Group 2 at baseline and after 15th day and 45th day



Graph 2: Mean plaque index scores in the two groups

	Green Tea (n=6)			CHX (n=6)			Un-Paired t-test	p
	Mean	SD	SEM	Mean	SD	SEM		
15 days	-0.144	0.249	0.102	-0.251	0.228	0.093		0.456
45 days	-0.239	0.186	0.076	-0.364	0.277	0.113		0.379

Table 5 : Change in Plaque scores from Baseline and after 15th day and 45th day



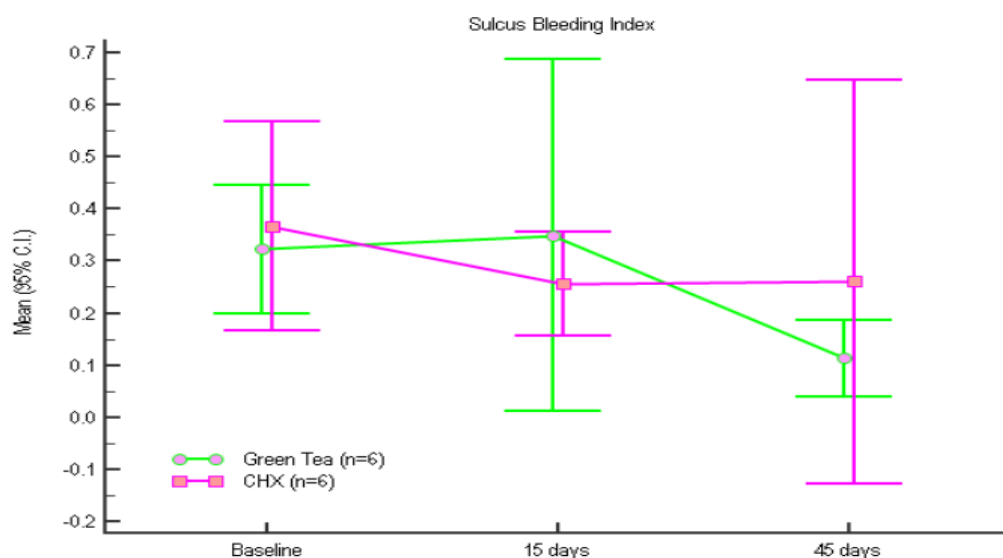
Graph 3: Change in plaque score from baseline to 15 and 45 days

The collective data of the mean sulcus bleeding index score of Group 1 and Group 2 at baseline, after 15 days and after 45 days is illustrated in Table 6 and 7. The mean sulcus bleeding index score at baseline were found to be 0.323 ± 0.118 and 0.367 ± 0.192 in 0.5% green tea mouthwash group and 0.2% Chlorhexidine mouthwash group respectively. After 15 days the values were found to be 0.350 ± 0.321 and 0.257 ± 0.095 in 0.5% green tea mouthwash group and 0.2% Chlorhexidine mouthwash group respectively. At the final visit after 45 days the final sulcus bleeding index values were found to be 0.114 ± 0.070 and 0.260 ± 0.368 in 0.5% green tea mouthwash group and 0.2% Chlorhexidine mouthwash

group respectively. This indicated a change of 0.026 ± 0.364 and -0.210 ± 0.129 from baseline to 15 days and 45 days respectively in 0.5% green tea mouthwash group. A change of -0.110 ± 0.216 and -0.107 ± 0.461 from baseline to 15th and 45th day respectively was noted in the 0.2% Chlorhexidine mouthwash group. The paired t test for inter group comparison showed no significant difference in the values at 15th day and 45th day. On intragroup comparison, however, a statistically significant difference was observed in the 0.5% green tea mouthwash group at 45th day as compared to the baseline.

	Green Tea (n=6)			CHX (n=6)			Un-Paired t-test <i>p</i>
	Mean	SD	SEM	Mean	SD	SEM	
Baseline	0.323	0.118	0.048	0.367	0.192	0.078	0.647
15 days	0.350	0.321	0.131	0.257	0.095	0.039	0.514
45 days	0.114	0.070	0.029	0.260	0.368	0.150	0.361
Within group comparisons							
	<i>p</i>						
Baseline Vs Day 15	0.866			0.268			
Baseline Vs Day 45	0.010			0.596			

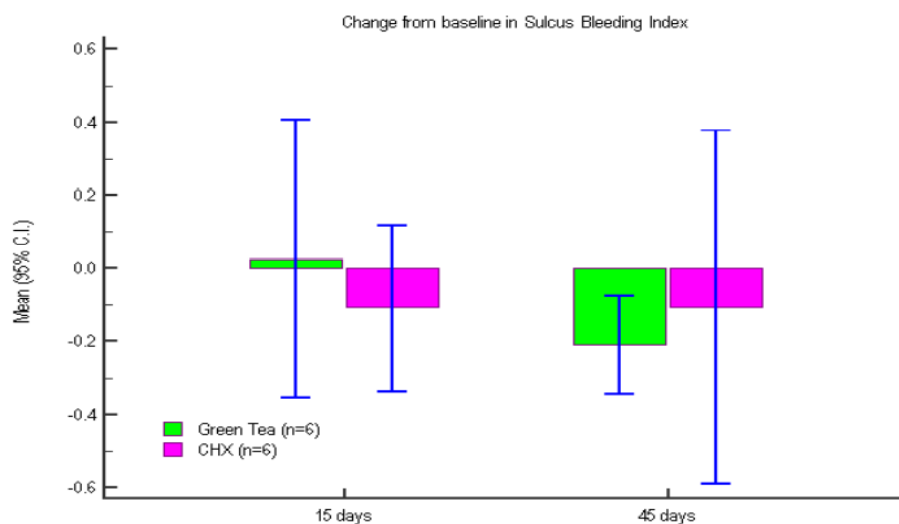
Table 6: Comparison of the mean sulcus bleeding scores of Groups 1 and Group 2 at baseline and after 15th day and 45th day.



Graph 4: Graph showing mean sulcus bleeding score of Group 1 and Group 2 at baseline after 15 days and 45 days

	Green Tea (n=6)			CHX (n=6)			Un-Paired t-test
	Mean	SD	SEM	Mean	SD	SEM	p
15 days	0.026	0.364	0.148	-0.110	0.216	0.088	0.449
45 days	-0.210	0.129	0.052	-0.107	0.461	0.188	0.609

Table 7: Change in sulcus bleeding index from baseline to 15th days and after 45th day.



Graph 5: Graph showing change in sulcus bleeding score from baseline to 15 and 45 days

DISCUSSION

The study was carried out to assess and compare the antiplaque effectiveness of Green Tea mouthwash and Chlorhexidine mouthwash on orthodontic patients. This was a double blinded study where the investigator and the study subjects were not aware to which group the subjects belonged to. No side effects or miss-happenings

were seen during the study period. Comparisons with other studies could not be carried out as the materials used were different as well as the study population was also different. The study period and the time interval also differed from other studies. Popular indices such as the gingival index and plaque index were used for

investigating the efficiency of oral hygiene products similar to other studies.^[12-15]

Green tea mouthwash Originating from China, Green tea has gained the world's taste in the past 2000 years.^[16] The economic and social interest of Green tea is clear and its consumption is part of many people daily routine, as an everyday drink and as a therapeutic aid in many illnesses.^[16] The first clue to the oral health benefits of tea came from studies in the 1940 s to 50 s showing fluoride to be the active component.^[17]

Reports suggested not only fluoride but also tannins contributed to the inhibitory effect.^[18-21] In the present study, subjects under Green tea had the maximum desired effect when compared to and Chlorhexidine. The gingival level scores declined for Green tea mouthwash at 45th day. The oral hygiene status improved from poor to good. Green Tea group had upper hand in terms of gingival status, as the response was very good and quick when compared to chlorhexidine. One of the reasons for significant reduction in the gingival scores would be attributed to levels of the catechins, tannins, and astringent present in the tea. This finding is consistent with other studies which have reported similar results with that of tea tree oil.^[22,23] Various other mechanisms have been explained for the effect of tea on gingival health. Green tea catechin has been shown to be bactericidal against *Porphyromonas gingivalis* and *Prevotella* species in vitro.^[24] Green Tea catechins containing the galloyl radicals possess the ability to inhibit both eukaryotic and prokaryotic cell derived collagenase, an enzyme that plays an important role in the disruption of the collagen component in the gingival tissues of patients with periodontal disease.^[25,26] Catechin derivatives have been reported to inhibit certain proteases of *P. Gingivalis* and may reduce periodontal breakdown.^[27] Green tea catechins have also been shown to inhibit protein tyrosine phosphatase in *Prevotella intermedia*.^[28] EGCG has been reported to inhibit production of toxic metabolites of *P. Gingivalis* have shown that purified Green tea polyphenols inhibited in vitro growth and H₂S production of *P. gingivalis* and *Fusobacterium nucleatum* associated with human halitosis.^[29]

Chlorhexidine mouthwash

Chlorhexidine digluconate, to date is the most thoroughly studied and the most effective anti-plaque and antigingivitis agent. However, several side-effects associated with its use have stimulated the search for alternative agents. For this reason, only it is taken as a benchmark control for various mouthwashes. The most commonly prescribed concentration is 0.2% hence; this was considered in the study. As expected the mean plaques scores reduced from baseline to 15th day. The lowest plaque was recorded after the first rinse. The drop was found to be clinically significant. Same goes with gingival scores, were clinically significant reduction of gingivitis was seen at baseline to at the end of 15th day.

Oral hygiene which was poor at baseline for subjects, after use of mouthwash oral hygiene improved to mild. Similar positive results have been reported in other studies.^[30-32]

CONCLUSION

Effective use of mouthwash oral hygiene improved to mild. Similar positive results have been reported in other studies.^[29-31] In regards to the strengths and limitations of the study, this study was one of the few surveys that compared the natural Green Tea mouthwash with chemical based counterparts among orthodontic patients. The randomized control trial, which is the strongest of the study design was employed to have control of the exposure and to eliminate various bias.^[32] However, this study has some limitations worth reporting. The limited number of participants in each group may question the validity of the results. Further research could be carried out by recruiting more participants and by evaluating the results with this study.

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