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COMPARISON BETWEEN TEA TREE OIL AND CHLORHEXIDINE MOUTH RINSE IN TREATMENT OF GINGIVITIS INDUCED BY ORTHODONTIC TREATMENT: A RANDOMIZED CONTROL CLINICAL STUDY

Ghada Elmehy* *and* Tamer Elamer Abo-Shady**

ABSTRACT

Aim: This study was designed to compare the effects of tea tree oil and chlorhexidine mouth rinse in the treatment of gingivitis induced by orthodontic treatment.

Materials and Methods: Sixty patients undergoing orthodontic treatment and suffering from gingivitis were included and divided randomly into three groups, group I (20 patients): Patients received scaling and oral hygiene instructions, group II (20 patients): Patients received scaling, oral hygiene instructions and chlorhexidine mouth rinse and group III (20 patients): Patients received scaling, oral hygiene instructions and tea tree oil mouth rinse.

Results: The results of this study revealed that all treatment modalities achieved a statistically significant reduction of the mean plaque index, gingival index and papillary bleeding index throughout the six months evaluation period as compared to the mean base-line values ($P<0.001$). This 6-month controlled clinical study demonstrated that the tea tree oil mouth rinse had comparable anti-gingivitis activity with chlorhexidine mouth rinse which is known to produce significantly higher levels of extrinsic stain.

Conclusion: Due to side effects associated with the chlorhexidine mouth rinse, it is suggested that tea tree oil mouth rinse can be used instead, as it proved to have a distinct role in the management of gingivitis induced by orthodontic treatment.

KEY WORDS: Chronic gingivitis, Orthodontic treatment, Chlorhexidine mouth rinse, Tea tree oil mouth rinse.

INTRODUCTION

Orthodontic treatment with fixed appliances modifies the oral environment[1]. Plaque increases around bands and brackets[2], the composition of the oral flora changes[3], and cleaning becomes more difficult for the patient[4]. As a result, gingival inflammation and enamel decalcification around fixed appliances can result in the absence of preventive programs [5].

* Ass. Professor of Orthodontics Department, Faculty of Dentistry, Tanta University.
** Lecture of Oral Medicine and Periodontology Department, Faculty of Dentistry, Tanta University

Plaque control and prevention of gingivitis is the main goal for the prevention of periodontal diseases. Therefore, in addition to mechanical oral hygiene, the use of antiseptics is strongly recommended and performed [6]. Among a variety of antiseptic agents, chlorhexidine digluconate (CHX) has been used and tested for many years. The efficiency of CHX 0.2% in preventing plaque formation and development of gingivitis has been demonstrated in previous publications [7, 8]. To date, it represents the gold standard among the anti-plaque agents [9].

Natural products have served as a major source of drugs for centuries, and about half of the pharmaceuticals in use today are derived from natural products [10]. Among these materials, tea tree oil (Melaleuca alternifolia) (TTO) is derived from the bark of tea tree [11] and has a broad-spectrum antimicrobial activity [12], anti-fungal [13], anti-viral [14], antioxidant [15] and anti-inflammatory effects [16, 17].

The aim of this study was to compare 0.2% CHX and 1% TTO mouthrinse plus scaling versus scaling alone on chronic gingivitis induced by orthodontic treatment.

MATERIALS AND METHODS:

A prospective randomized trial was carried out on 60 patients undergoing orthodontic treatment at the Department of Orthodontic, Faculty of Dentistry, Tanta University from April 2016 to January 2017. This study included 21 males and 39 females, the patients' ages ranged between 12 and 30 years. All of the patients were treated with fixed orthodontic appliances in the upper and lower arches and suffered from chronic gingivitis. Their informed consent was taken and all procedures were explained before treatment.

Inclusion criteria:

1. No clinical attachment loss (CAL).
2. Patients with good systemic health
3. Patients who are able to maintain good oral hygiene
4. Patients with straight wire orthodontic appliances.

Exclusion criteria:

- Any systemic disease that could affect the periodontium.
- Pregnancy.
- Taking anti-inflammatory drugs, antibiotics or vitamins within the previous 3 month.
- Using mouth washes regularly
- Heavy smoking (> 10 cigarettes/day)
- History of alcohol abuse
- Participation in other clinical trials.
- History of previous orthodontic treatment.

Materials

- Australian tea tree oil (Melaleuca alternifolia) was used as a mouth rinse and was prepared follows:

Tea tree oil was purchased from Sigma® (Steinheim Germany). 1 ml tea tree oil was diluted with 100 ml warm water, resulting in a final concentration of 1% TTO [18]. From this solution, 15ml was used as a mouth rinse.

- Chlorhexidine 0.2% mouth rinse.

Patients' groups

Patients were divided randomly by random number table drawn up by a professor of statistics into three groups:

Group I (Control group- 20 patients)

All patients received oral hygiene instructions and scaling (with hand instruments) for all teeth + removal of all stains and polishing the teeth with a slow running bristle brush.

Group II (Test group- 20 patients)

All patients received oral hygiene instructions and scaling (with hand instruments) for all teeth + removal of all stains and polishing the teeth with a slow running bristle brush + 0.2% chlorhexidine mouthrinse twice daily for 2 min with 15 ml.

Group III (Test group- 20 patients)

All patients were received oral hygiene instructions and scaling (with hand instruments) of all teeth + removal of all stains and polishing the teeth with a slow running bristle brush + 1% tea tree oil mouthrinse twice daily for 2 min with 15 ml.

No anti-inflammatory agents were prescribed after treatment.

Clinical Measurements

Plaque index (PI) according to ***Silness & Loe, (1964)*** [19], Gingival index (GI) according to ***Loe & Silness, (1963)*** [20], Papillary bleeding index (PBI) according to ***Mühlemann (1977)*** [21], intensity stain index (ISI) according to **Loebene et al., (1989)**[22] were evaluated on the labial surfaces of the 12 anterior teeth at 1, 3, and 6 months after treatment.

Statistical analysis

All the results were tabulated and statistically analyzed using computer software named the Statistical Package for Social Science (SPSS version 10). Comparison within and between the studied groups were performed with independent samples student t-test, paired t-test and one-way ANOVA (F-testing), at a level of 5 % significance.

RESULTS

All patients participated in the whole study period. However, group III complained from intensive and unpleasant taste of the TTO solution.

In the meantime, the mean baseline values of plaque index (PI), gingival index (GI), Papillary bleeding index (PBI) and intensity stain index (ISI) showed no significant difference between the treated groups.

In the present study all treatment modalities achieved a statistically significant reduction of the mean PI & GI and PBI scores which continued up to the end of the 6 months evaluation period as compared to the mean baseline values ($P < 0.001$).

However, group II showed a more significant reduction in PI after 1, 3 and 6 months after treatment (Figure 1). Moreover, at all evaluation points the reduction in GI and PBI scores was statistically different and more obvious following the adjunctive therapy of the tested groups compared with the control group *($P < 0.01$* & $P < 0.001$; *Table 1, Figures 2, 3)*.

Furthermore, the data showed that in group II, there was statistically significant increase in ISI as compared to group I & group II and which continued up to the end of the 6 months evaluation period (*$P < 0.001$; Table 1, Figure 4)*.

TABLE (1) Mean values of plaque index (PI), gingival index (GI), Papillary bleeding index (PBI) and intensity stain index (ISI) among the study groups at 1, 3 and 6 months post-treatment.

		Group I= scaling only n= 20	**Group II= scaling + CHX n=20**	**Group III= scaling + TTO n=20**	**F-test P**
PI	Base-line (1)	1.56±0.36	1.67±0.25	1.73±0.22	1.915 P= 0.157
	1 months(2)	0.51±0.32	0.25±0.19	0.37±0.17	5.829 P< 0.01
	3 months (3)	0.57±0.34	0.28±0.18	0.45±0.26	5.578 P< 0.01
	6 months (4)	0.58±0.31	0.28 ± 0.21	0.43 ± 0.22	6.744 P< 0.01
	t- test	1 vs 2 P< 0.001 1 vs 3 P < 0.001 1 vs 4 P< 0.001	1 vs 2 P< 0.001 1 vs 3 P < 0.001 1 vs 4 P< 0.001	1 vs 2 P< 0.001 1 vs 3 P < 0.001 1 vs 4 P< 0.001	
GI	Base-line (1)	2.17±0.48	2.25±0.48	2.36±0.37	0.859 P= 0.429
	1 months (2)	0.65±0.23	0.37±0.12	0.33±0.14	18.732 P< 0.001
	3 months (3)	0.70±0.20	0.31±0..11	0.32±0.11	41.818 P< 0.001
	6 months (4)	0.72±0.19	0.30±0.10	0.30±0.13	54.366 P< 0.001
	t- test	1 vs 2 P<0.001 1 vs 3 P<0.001 1 vs 4 P<0.001	1 vs 2 P<0.001 1 vs 3 P<0.001 1 vs 4 P<0.001	1 vs 2 P<0.001 1 vs 3 P<0.001 1 vs 4 P<0.001	
PBI	Base-line (1)	2.53±0.67	2.72±0.71	2.91±0.71	1.435 P<0.001
	1 months (2)	0.48±0.16	0.13±0.11	0.15±0.12	41.565 P<0.001
	3 months (3)	0.51±0.16	0.12±0.10	0.14±0.12	56.039 P<0.001
	6 months (4)	0.55±0.21	0.13±0.10	0.16±0.11	45.676 P<0.001
	t- test	1 vs 2 P<0.001 1 vs 3 P<0.001 1 vs 4 P<0.001	1 vs 2 P<0.001 1 vs 3 P<0.001 1 vs 4 P<0.001	1 vs 2 P<0.001 1 vs 3 P<0.001 1 vs 4 P<0.001	
ISI	Base-line (1)	00±00	00±00	00±00	
	1 months (2)	0.17±0.15	1.47±0.47	0.13±0.23	114.667 P<0.001
	3 months (3)	0.19±0.16	1.82±0.74	0.14±0.23	85.478 P<0.001
	6 months (4)	0.22±0.18	2.00±0.64	0.15±0.24	127.982 P<0.001

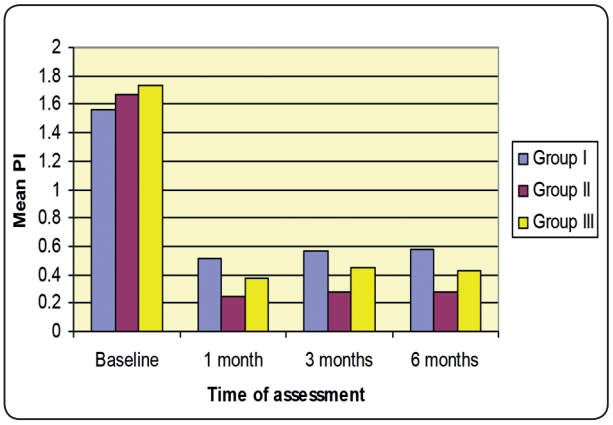

Fig. (1) Mean values of plaque index (PI) among the study groups at base-line, 1,3 and 6 months post-treatment.

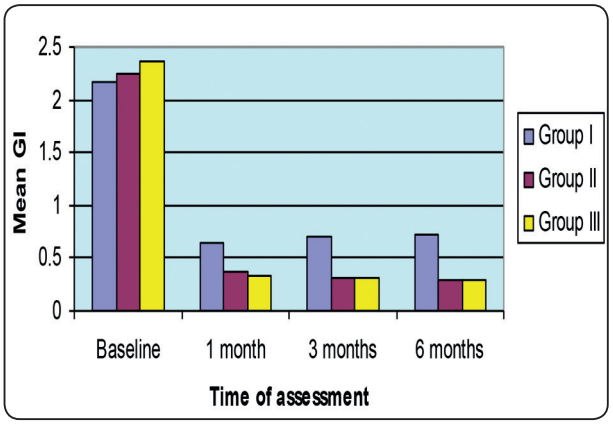

Fig. (2) Mean values of gingival index (GI) among the study groups at base-line, 1,3 and 6 months post-treatment.

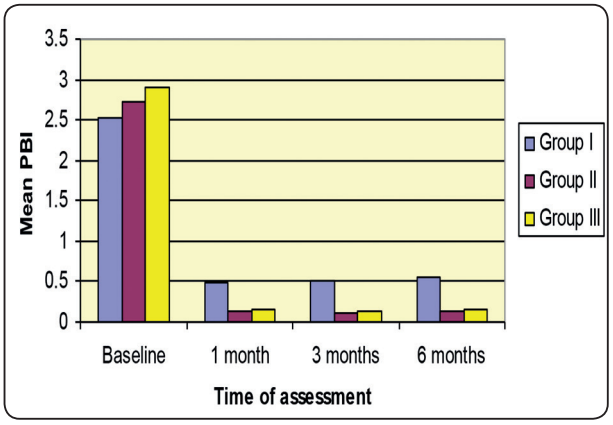

Fig. (3) Mean values of papillary bleeding index (PBI) among the study groups at base-line, 1,3 and 6 months post-treatment.

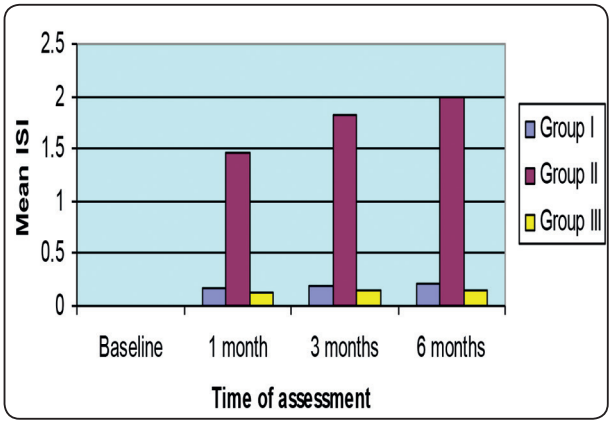

Fig. (4) Mean values of intensity stain index(ISI) among the study groups at base-line, 1,3 and 6 months post-treatment.

DISCUSSION

CHX is a relatively safe drug; this may be due to its poor systemic absorption. However, it shows some side effects such as objectionable taste, discoloration of teeth and restorations, as well as brownish discoloration of the dorsum of the tongue[23]. Scientific evidence suggests that tea tree oil may be useful in the maintenance of oral hygiene, prevention of dental disease and may be an effective agent for both the prevention and treatment of oral infections [18]. The present study was carried out to compare the 0.2% CHX and 1% TTO mouth rinse plus scaling versus scaling alone on chronic gingivitis induced by orthodontic treatment.

Results of PI revealed that there was a significant reduction at all evaluation periods in the three treated group. This clinical trial demonstrated that there was significant reduction in the PI in group II as compared to groups I and III at 1, 3 and 6 months.

In CHX group, the reduction in PI may be attributed to the antiplaque effect of CHX. It is postulated that CHX achieved its antiplaque effect as a result of an immediate bactericidal action at the time of application, followed by a prolonged bacteriostatic action as a result of CHX adsorbing to the pellicle coated enamel surface. This implied that tooth surface bound CHX is of great importance in preventing plaque formation [24].

At all evaluation periods, the reduction in PI in TTO and control groups may be attributed to mechanical oral hygiene procedures. There was no statistically significant difference between group I and III in the mean PI during the study periods. The results of the present study were in agreement with the clinical results reported by ***Arweiler et al., (2000)*** [25] who described the efficacy of a TTO used as mouthwash on plaque formation. They found that the plaque index in the group treated by TTO mouth wash did not differ from placebo mouthwash on any day from the study period. Also, our results were in agreement with the clinical results reported by ***Soukoulis & Hirsch, (2004)*** [11] who performed a double-blind, longitudinal study to evaluate the effect of TTO gel (2.5%) applied to toothbrush twice daily. They found that TTO did not reduce plaque scores.

Results of the present study showed a significant reduction in the GI and PBI scores during the study periods in all groups as compared to baseline values. In groups II and III, results showed a significant improvement in GI and PBI as compared to group I at all evaluation periods**.** These results were in agreement with ***Charles et al., (2004)*** [26]***, Olympio et al., (2006)*** [4] ***and Lorenz et al., (2006)*** [27] who reported that CHX was able to inhibit plaque re-growth and gingivitis. The reduction in GI and PBI in CHX group may be attributed to antibacterial action of CHX. At low concentration, the CHX is bacteriostatic, whereas at higher concentration the CHX is rapidly bactericidal [28]**.**

These results are consistent with the study of ***Soukoulis et al., (2004)*** [29] in which TTO gel used twice daily with a toothbrush as a dentifrice was found to significantly reduce inflammation and bleeding of the gingiva in people with severe gingivitis. Also, the previous results were in agreement with ***Juergens et al., (1998)*** [30]**,** ***Hart et al., (2000)*** [31] and ***Brand et al., (2001)*** [16]**,** who found decreased gingival inflammation with the use of TTO and explained their results by the anti-inflammatory activity of TTO. ***Brand et al., (2001)*** [16] showed that TTO suppressed the production of superoxide by human monocytes. Another extra explanation of the anti-inflammatory of TTO was explained by ***Juergens et al.,*** (1998) [30] who showed a significant decrease in the production of cytokines (TNF-α & IL-1β) from lipopolysaccharides (LPS) stimulated monocytes in response to the administration of Soledum® (containing 1, 8-cineole).

The present results revealed that levels of extrinsic tooth stain were significantly higher in the chlorhexidine group than in the TTO and control groups, this result was similar to that reported by ***Charles et al., (2004)*** [26], who compared between essential oil mouthrinse and the chlorhexidine mouthrinse and they found that chlorhexidine mouthrinse group had significantly more calculus and extrinsic tooth stain than either the essential oil mouthrinse group or the control group. ***Olympio et al., (2006)*** [4] analyzed the results of using chlorhexidine dentifrices in relation to dental plaque, gingivitis, bleeding, calculus and enamel extrinsic staining development in orthodontic patients. They found that chlorhexidine dentifrices significantly increased the mean of the stain index, although most of the patients did not notice the stains. Also, our results were in agreement with ***Overholser et al., (1990)*** [32] and ***Lorenz et al., (2006)*** [27] who found that the chlorhexidine significantly increased the mean of the stain index.

Therefore, it is likely that the chlorhexidine mouthrinse could have a greater role in situations when short-term plaque control is critical and usual mechanical oral hygiene procedures are difficult, e.g., in the immediate post-operative period after periodontal surgery, and the TTO mouthrinse could have a role in the longer-term control of plaque and gingivitis during the maintenance phase of therapy and orthodontic treatment.

In summary, this 6-month controlled comparative clinical trial demonstrated that the TTO mouthrinse and the chlorhexidine mouthrinse had comparable anti-gingivitis activity, with the chlorhexidine mouthrinse producing significantly higher levels of extrinsic stain.

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