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Effectiveness of Tea Tree Oil and Chlorhexidine as Mouth Rinse in the Control of Dental Plaque and Chronic Gingivitis – A Comparative Study.

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Abstract: Objective: Increasing prevalence of periodontitis makes it one of the most important problems in public health. Microbial plaque is one the causative factor for gingival and periodontal diseases. The problem associated with side effects of chemical aids, stimulated the search for alternative antiplaque, antigingivitis agents. Hence study done with aim to compare the efficacy of mouth rinses containing Tea Tree Oil (TTO) and Chlorhexidine (CHX) in reduction of existing plaque and gingivitis. Method: A triple blind randomized control study was conducted among 12-15yr old participants having moderate –severe type of gingivitis. Participants were randomly divided in to three groups i.e., Chlorhexidine, Tea Tree Oil and Placebo groups with 30 participants in each making total sample of 90. Baseline data of gingival status of each participant was collected using plaque and gingival index. Later participants were given 10ml of TTO, CHX and placebo mouth-rinse daily for 15 days. Effect of mouth rinses were assessed on 7th day and 15th day of study period respectively. Results: In both, the TTO and Chlorhexidine group, there was significant reduction in plaque and gingival scores from baseline to 15th day, but there was no statistical significant difference between these groups. Conclusion: Our study suggests that, mouth rinse with the TTO has similar effect as Chlorhexidine in reduction of plaque and gingival scores. Hence, the TTO being a natural product and cost effective can be recommended as mouthrinse.
Keywords: Chlorhexidine, Gingivitis, Mouthrinse, Plaque, Tea Tree Oil.

Key Message:

- Tea Tree Oil (TTO) is one of the natural product is, which is product of paperbark tea tree. *In-vitro and in-vivo* studies have shown its antibacterial and anti-inflammatory efficacy

- This study demonstrates that, mouth rinse with the TTO & Chlorhexidine produced similar effect in reductions of supragingival plaque and gingivitis scores.
- TTO being natural product with similar antibacterial, antiseptic properties that of Chlorhexidine could be suggested for dental application as mouth rinse.

Introduction:

Increasing prevalence of periodontitis makes it one of the most important problems in public health. Microbial plaque is one the causative factor for gingival and periodontal diseases. To control its formation and removal many mechanical and chemical measures are used. Mouthwashes are used as an adjunct to mechanical plaque control aids. Chlorhexidine (CHX), a bisbiguanide, considered to date the most effective antiplaque agent, is not easily formulated into toothpastes, and local side effects, especially reversible brown staining of teeth, tongue and resin restorations, and transient impairment of taste perception have limited the long term use of CHX as a mouthwash. [1-6] The problem associated with side effects stimulated the search for alternative antiplaque, antigingivitis agents.

Many alternative medicine are entering in the field of dentistry in the form of dentifrice, mouth rinses, one such natural product is Tea Tree Oil (TTO), which is product of paperbark tea tree. TTO has been used widely in many cosmetic, medicinal and dental products. Some in-vitro and in-vivo studies have shown that antibacterial and antiinflammatory activities and related to the active ingredients such as 1,8-cineole and terpinen-4 ol. [7, 8] contain potential antimicrobial components. Continuous effort is has been made to search patient friendly mouthwash having the ability of anti-plaque and anti-gingivitis properties.

The aim and objective of this study was to assess and compare the efficacy of mouth rinse containing TTO and Chlorhexidine on reduction of existing plaque and gingivitis.

Materials And Methods

Collection of TTO extract: The TTO extract procured was identified and authenticated by the Department of Pharmacogonsia J.S.S. College of Pharmacy Mysore The mouth wash was prepared in a sterile beaker by mixing 2 grams of tween 80, 2 ml of TTO, then the mixture is added to two liters of distilled water to makeup required concentration.(0.2%). The chlorhexidine (0.12%) mouth rinse was procured from the pharmacy.

Study design: An experimental *in vivo* triple blind study, using three groups.

Group A: TTO (0.2%)
Group B: Chlorhexidine (0.12%)
Group C: Placebo

Duration of study: 2 weeks.

Source of data: Volunteers were recruited from JSS high school, Bannimantap, Mysore. Study protocol was explained to them in detail during parent teacher meeting and obtained informed consent from them. Selection criteria had a dentition with minimum 20 teeth, Children with moderate to severe plaque induced gingivitis, no orthodontic appliances, no known allergy to any of the components of mouthwashes and no antibiotic use for the last 3 months, no known systemic diseases. Ethical clearance was obtained from institutional ethical committee board [Jssdch/acad/105/2009-10].

Sample selection: Out of the total 150 students aged between 12 and 16years, 90 students were selected based on above mentioned criteria.

Study procedure*:* The 90 subjects were divided by simple random method (lottery) into three groups with 30 participants in each group, who were either given TTO, Chlorhexidine and placebo

mouth rinse. At the beginning of the study, all mouthwashes were placed in the same kind of containers and labeled as A, B, C. According to the alphabet which participants got they are given respective numbered mouth wash.

Before the examination was started, personal information regarding the subject such as demographic characters, oral hygiene practices were recorded in specially prepared proforma. Training and calibration for the investigator was done. The Plaque Index (Silness and Loe) and the Gingival Index (Loe and Silness) were used to assess the plaque accumulation and gingivitis.[9] The baseline data of plaque and gingival health were recorded. Daily for fifteen days, students belonging to each group were made to assemble in the corridor in front of their classroom stand in que, 10ml of three mouth rinses were given in a disposable cup to the students in the morning at 9 am. They were instructed to rinse for one minute and later spit into sand mud filled bucket. All these procedure were conducted under the supervision. They were instructed not to eat or drink for next 30 minutes. They were also instructed to report any change in taste perception, burning sensation, alteration in breath and staining. The students were examined with sufficient time between each student to prevent fatigue of the examiner. Examinations were conducted at two schedules one in morning (10 am to12 pm) and in the afternoon (1.30pm to 3.30pm). At the time of examination, subjects were questioned regarding solution taste, breath alteration, burning sensation and systemic adverse effects. The gingival health was recorded by using Plaque Index and Gingival Index on 7th day and 15th day. Collected data were analyzed by using SPSS software (version 16- (SPSS Inc., New York, USA)). P value of < 0.05 was considered statistically significant.

Results: A triple blind study was conducted on 90 school children to evaluate the efficacy of mouth rinse containing TTO and commercially available Chlorhexidine on reduction of existing plaque and gingivitis. Out of 90 students 47.8 % (43) were males and 52.2 % (47) females. Table 1 and 2 shows mean and standard deviation of plaque and gingival index scores recorded at baseline, 7th day and on 15th day of usage of three mouth rinses.

The reduction of PI scores from baseline, 7th and 15th day was seen among all the groups. The ANOVA test was applied and the reduction was found to be significant among the groups A and B (P=0.000) (Graph1)

Similarly reduction of GI scores from baseline, 7th and 15th day was seen among all the groups. The ANOVA test was applied and the reduction was found to be significant among the groups A and B (P=0.000) (Graph 2)

In both, the TTO and Chlorhexidine group, there was significant reduction in plaque and gingival scores from baseline to 15th day, but there was no statistical significant difference between these groups.

Compliance: One student reported alteration in taste and breath, burning sensation in group A (tea tree mouthrinse group).

Discussion: The present short term study was conducted on ninety (90) school children to evaluate the efficacy of mouth rinse containing TTO and commercially available CHX on reducing existing plaque and gingivitis. The design of the study was intended to represent conditions of the general public especially teenage children as far as possible, therefore no pre-study prophylaxis was given and no oral hygiene instructions were offered.

In a study [10] conducted among 23 -34yrs of age; however in the current study 12-15 years old children were taken into consideration with an idea that this group was more vulnerable for developing gingivitis due to many factors e.g. hormonal changes , changing dietary pattern, erupting permanent tooth. Incorrect brushing habit is one of the primary factors for this group due

to lack of motivation, complete maneuver dexterity. Whereas developing gingivitis alone in older population is not very common, because some of the tooth might have progressed to periodontitis, as compared to the younger age group.

There is no previous clinical trial on different mouth rinses which described the distribution of individuals according to the method of oral hygiene practice. In the current study we notice that most of the students use tooth brush, in all three groups of mouthrinse but still, at base line PI and GI was quite higher. This indicates that they were neither using either the proper technique of tooth brushing nor using it for required duration.

Majority of the students 75(83.3%) among all the group were in a habit of changing the brush in 1-3months. This shows that they were not using proper brushing technique because this plaque accumulation was higher at base line.

General improvements in plaque scores among all subjects were observed at time of 7th day examination this can be due to hawthorne type of effect or participants involvement in the study may have been a motivating factor for improvement in their oral hygiene practice. But examination on 15th day showed much reduction in plaque scores i.e., 15.10% in group A., 12.50 % in group B whereas for group C, it was 4.73% reduction. The decreased in mean plaque score in groups A and B when compared to group C that might be due to placebo effect. Even though there is reduction in plaque score in group C on 15th day compare to baseline that reduction might be due to subjects may have thought that the investigator is supervising regularly and he expects reduction in gingival inflammation to achieve that the subjects might have increased their oral hygiene efforts.

This controlled comparative clinical trial demonstrated that the TTO and Chlorhexidine mouth rinse produced significant reductions in supragingival plaque and gingivitis when used as adjuncts to subject's usual mechanical oral hygiene procedures. The findings that the respective 15th day plaque and gingivitis reductions were not statistically significantly different from each other indicate that the two active mouth rinses had comparable clinical effectiveness but the previous pilot study conducted to know the antimicrobial effect of TTO says there are no effect of TTO on plaque re-growth and the vitality of supra-gingival micro flora.[10]

A study [11] conducted for 6 months where Listerine mouthwash showed a reduction of 34% reduction in plaque score and other study [12] on chlorhexidine found only 16% reduction in plaque score.

The gingival scores showed a trend similar to that of the plaque scores in relations to the examinations done at 7th day. Examination done at 15th day showed there was reduction in gingival score 21.15% in group A, group B 20.75%, and group C 8.0%. A study [13] on usage of Listerine mouth rinse showed a reduction of 23.9% of gingival score which was almost similar to current study. A double-blind experimental gingivitis model study [14] showed chlorhexidine mouthwash was much effective as antiplaque and antigingival agent compared to Listerine, meridol.

The present study showed that TTO has antiplaque and anti-inflamatory effect as chlohexidine. A randomized study[15] between TTO and cetylpyridinium chloride mouthwashes showed TTO reduced plaque score compared to placebo but not like cetylpyridinium chloride. One of the study[16] reported significant reductions in gingival inflammation with TTO gel when compared to placeboand positive control gels (CHX). However, TTO gel did not reduce the plaque scores. It might be due to poor substantivity or loss of its antibacterial properties once bounded to oral tissues. [7,8] More studies are needed to study this matter.

Burning and alteration of taste was observed in one students of TTO group. This might be due to TTO essential oil with a fresh camphoraceous odor. Chromatographic analyses of TTO showed adequate concentration of cineole (< 15%) and terpinen- 4-ol (>30%) according to Australian Standard AS 2782-85. The emulsifying agent (tween 80) was used because it does not interfere with the oil antimicrobial properties.[7] It is taken from the leaves of the Melaleuca alternifolia which is native to the northeast coast of New South Wales, Australia. The oil has beneficial medical properties (including antiseptic and antifungal, antibacterial action). The essential oil of M. alternifolia (TTO) may have some side effects such as being toxic if ingested in higher doses and may cause skin irritation and allergic reaction.[17]
Some compliances were seen in one of the comparative study among TTO, garlic and CHX mouthwash against oral microorganisms reported unpleasant taste 30% with TTO and 40% with CHX, burning sensation 60% with TTO and 40% with CHX.[18]
Limitation: Small sample size and short duration study. Further studies have tobe conducted to assess long-term effects, its substantivity etc

CONCLUSION: Our study demonstrates that, mouth rinse with the TTO & Chlorhexidine produced similar effect in reductions on supragingival plaque and gingivitis. TTO being natural product with similar antibacterial, antiseptic properties that of chlorhexidine could be suggested for dental application as mouth rinse. The mouth rinse containing Chlorhexidine and TTO were found to be equally effective but further studies are required to know the substantive and other adverse effects. This controlled comparative clinical trial demonstrated that the TTO and Chlorhexidine mouth rinse produced significant reductions in supragingival plaque and gingivitis when used as adjuncts to subject's usual mechanical oral hygiene procedures. The findings that the respective 15th day plaque and gingivitis reductions were not statistically significantly different from each other indicate that the two active mouth rinses had comparable clinical effectiveness.

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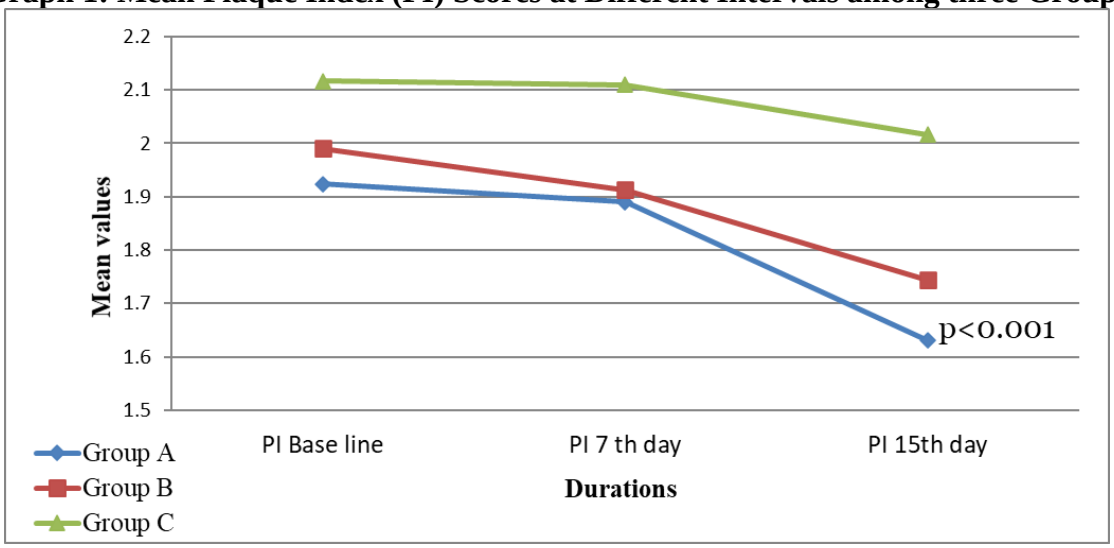
Table 1: Distribution of mean plaque index (PI) scores of three groups at different intervals

Plaque Index Scores	**Groups**	**Baseline**	**7th day**	**15th day**
		Mean ± Sta.dev	**Mean ± Sta.dev**	**Mean ± Sta.dev**
	Group – A	1.92±0.38	1.89±0.38	1.63± 0.33
	Group – B	1.99 ± 0.36	1.91±0.35	1.74± 0.31
	Group – C	2.11± 0.38	2.11±0.38	2.02± 0.38

Table 2: Distribution of mean Gingival Index (GI) scores of three groups at different intervals

Gingival Index (GI) scores	**Groups**	**Baseline**	**7th day**	**15th day**
		Mean ± Sta.dev	**Mean ± Sta.dev**	**Mean ± Sta.dev**
	Group – A	1.04 ± 0.31	1.01± 0.29	0.84±0.29
	Group – B	1.06± 0.33	1.01± 0.31	1.14± 0.37
	Group – C	1.24 ± 0.35	1.23± 0.37	1.08±0.37

Graph 1: Mean Plaque Index (PI) Scores at Different Intervals among three Groups



Graph 2: Mean Gingival Index (GI) Scores at Different Intervals among three Groups