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Comparative evaluation of efficacy of hiora, *terminalia chebula* and chlorhexidine as mouth wash on dental plaque

Abstract

Introduction: Dental caries and periodontal diseases, the two arch criminals of oral cavity, are essentially caused by the micro-organisms present in dental plaque.

Aim and objectives: Evaluate the relative effectiveness of Chlorhexidine, Hiora, and *T. chebula* mouth rinses on plaque reduction.

Materials and method: The present study was a randomized controlled crossover clinical trial. It was designed to evaluate and compare the efficacy of different mouth wash. Data obtained in relation to different assessing parameters at different phases of present study was subjected to statistical analysis using paired t- test.

Results: Chlorhexidine was more effective in reducing dental plaque compare to other mouthwashes.

Conclusion: Chlorhexidine shows better results compare to its herbal alternative but Hiora and *Terminalia chebula* mouthwash due to its natural ingredients has no reported side-effects and further studies with varied concentrations, different parameters and larger sample size are to be carried out to assess their efficacy of herbal mouthwash.

Keywords: dental plaque, chlorhexinde, hiora, Terminalia, chebula

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Abbreviations: *S. persica*, *Salvadora persica*; *T. chebula*, *Terminalia chebula*; *S. mutans*, *Streptococcus mutans*; PII, plaque index.

Introduction

Dental caries and periodontal diseases, the two arch criminals of oral cavity, are essentially caused by the micro-organisms present in dental plaque.[1] In India, nearly 60-65% of the child population is affected by dental caries and 10% has periodontitis.[2,3] Dental plaque plays an important role in the development of dental caries and periodontal disease, which results in both dysfunction and loss of tooth.[3] Mouthwashes are used to rinse the oral cavity for many reasons:

a. To remove or destroy bacteria.

b. To act as an astringent.

c. To deodorise.

d. To have a therapeutic effect by relieving infection or preventing dental caries.[4]

Hence these chemical methods of reducing plaque are appealing as they can provide significant benefits to patients who cannot maintain adequate mechanical plaque control.[5] The digluconate of Chlorhexidine is a synthetic antimicrobial drug which is effective *in vitro* against both Gram-positive and Gram-negative bacteria and considered as gold standard.[6]. But it cannot be used on a long term basis because of various side effects like brown discoloration, taste perturbation, oral mucosal lesions, parotid swelling, enhanced supragingival plaque formation, gingival desquamation, and sometimes unacceptable taste.[6] Hiora is an herbal mouthwash, has an active herbal ingredient: Meswak (*Salvadora persica*) which is a medicinal plant. It has been demonstrated that extracts of *S. Persica* improved gingival health and inhibited growth of cariogenic bacteria.[7] A study reported that the mouth rinse with aqueous salvadora twigs extract causes significant reduction (84%) in the adherence of bacterial cells (*Streptococcus mutans*) to buccal epithelial cells.[8] In recent years, there has been focus on plants or plant products used in folk dental practice and one such herbal cocktail is Triphala, the herbal product of equal proportion of dry powder of *Terminalia chebula*, *Terminalia belerica* and *Emblica officinalis*.[9] *T. chebula* suppress the growth of microbes, adherence of sugar and glucan induced aggregation of *S. mutans*. Mouth rinsing with a 10% solution of the extract inhibited microbial count. *T. chebula* demonstrated preventive action on dental caries has shown that owning to the microbial reduction may be attributed to the presence of tannins and flavonoid.[10]. An effective alternative to Chlorhexidine with all its good qualities and sans its unpleasant effects is highly desirable and has been long awaited. Literature review revealed very few *in vivo* studies worldwide assessing the effects of *T. chebula* extracts on dental plaque. Hence the present study was taken to evaluate the relative effectiveness of Chlorhexidine, Hiora, and *T. chebula* mouth rinses on dental plaque in 8-16year old children.

Materials and methods

The present study was a randomized controlled crossover clinical trial. The study was designed to evaluate and compare the efficacy of Hiora, *Terminalia chebula*, and Chlorhexidine as mouth wash on dental plaque among 8-16 year old orphanage children of Jaipur city. Following ethical clearance from the concerned committee of the institute, written permission was obtained from the head of the orphanage which harboured around 150 children between the age group of 8 to 16years. On clinical examination and case history recording on the proforma, 72 children between the age group of 8 to 16years were considered for present study based on the following inclusion & exclusion criteria:

Inclusion criteria

a. Subjects with good general health.

b. Minimum of 12 gradable teeth.

c. Comparable socio-economic status.

Exclusion criteria

Subjects with relevant medical condition

History of subjects with:

1. Early onset periodontitis.
2. Acute necrotizing ulcerative gingivitis.
3. Gross oral pathology.

Study material

a. 0.2% Chlorhexidine mouth wash (Hexidine) (500ml)

b. Hiora mouth wash (Himalaya) (150ml)

c. 10 % *Terminalia chebula* mouth wash

Grouping of subjects

Seventy two subjects considered for the present study into Group-1, Group-2 and Group-3 with 24 subjects in each group for use of three different mouthwashes during the three different phases of present cross over study. Modified Plaque index (PII) described by Loe H.[11] was used for assessing dental plaque. On procuring the baseline recording of dental plaque of subjects, the orphanage custodians of 24 subjects of each group were handed over 24 tooth brush and a tooth paste tube of 180 grams each with the instruction that, hence forth under their supervision the subjects will be taking care of their oral hygiene making use of the tooth brush and tooth paste provided for the purpose till the end of the study. Different phases of the study were described by the schematic diagram (Figure 1). Data obtained in relation to different assessing parameters at different phases of present study was subjected to statistical analysis using paired t- test.

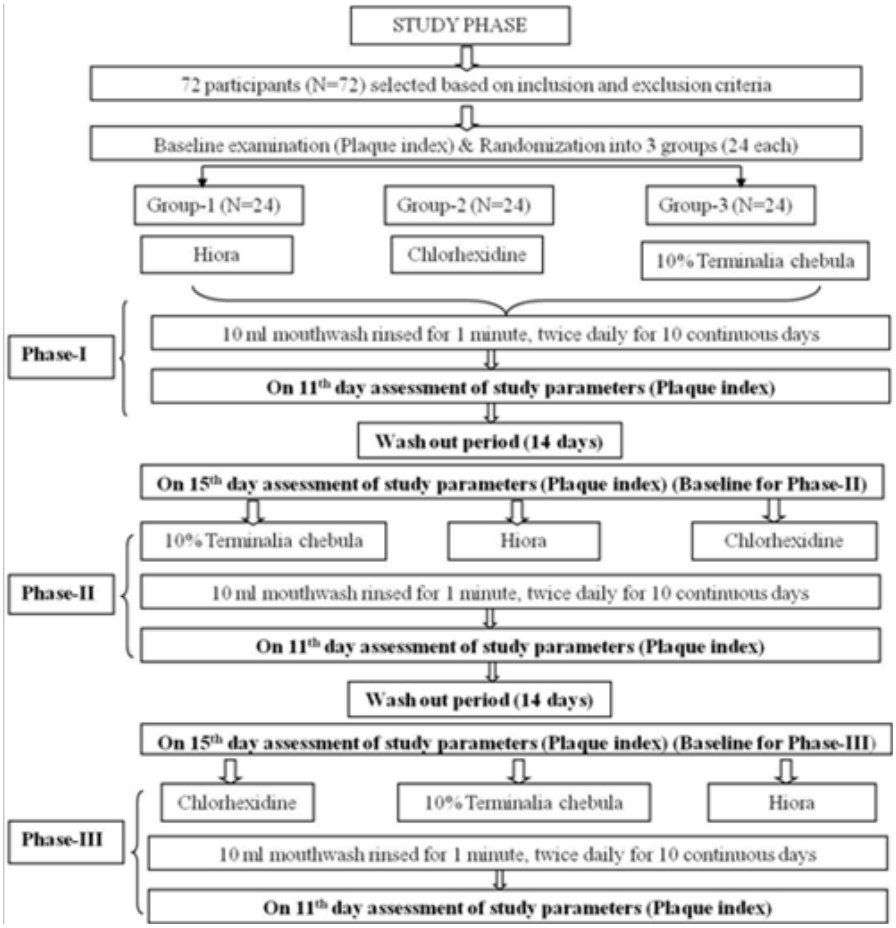

Figure 1 Different phases of the study.

Results and discussion

At the end of the study, all 72 subjects had used all the three study mouthwashes for a period of 10 days each in different phases of present study. In Hiora group, mean plaque index reading in phase I at baseline and after 10 days were observed to be 1.12±0.34 & 0.76±0.25 respectively with reduction in mean being 0.36. In phase II, mean plaque index reading at baseline & after 10 days of use of Hiora mouthwash was observed to be 0.54±0.20 & 0.41±0.18 respectively with reduction in mean being 0.13. In phase III, on using Hiora mouthwash, mean plaque index score was observed to be 0.27±0.05, whereas the same was observed to be 0.48±0.09 at baseline (Tables 1-3). In Chlorhexidine group in phase 1, mean plaque index reading at baseline & after 10 days of use of Chlorhexidine mouthwash was observed to be 0.50±0.17 & 0.24±0.07 respectively with reduction in mean being 0.26. In phase 2, on using Chlorhexidine mouth wash, mean plaque index score was observed to be 0.57±0.32 whereas the same was observed to be 1.23±0.44 at baseline. 0.66 was the reduction in mean recorded. Mean plaque index reading at baseline and after 10 days of usage of Chlorhexidine mouthwash in phase III was noted to be 0.76±0.29 & 0.44±0.19 respectively with reduction in mean being 0.32 (Tables 4-6). In *Terminalia chebula* group in phase I, mean plaque index reading at baseline & after 10 days of use of 10% *Terminalia chebula* mouthwash was observed to be 0.88±0.35 & 0.52±0.20 respectively with reduction in mean being 0.36. In phase II, on using 10% *Terminalia chebula* mouthwash, mean plaque index score was observed to be 0.30±0.06 whereas the same was observed to be 0.49±0.15 at baseline. 0.19 was the reduction in mean recorded. Mean plaque index reading at baseline and after 10 days of usage of 10% *Terminalia chebula* mouthwash in phase III was noted to be 0.99±0.46 & 0.65±0.35 respectively with reduction in mean being 0.34 (Tables 7-9).

Table 1 Comparison of mean PII at baseline & after 10 days of hiora use in phase I

Parameter	N	Baseline		After 10 days		Reduction		'p' value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	1.12	0.34	0.76	0.25	0.36	0.18	<0.001

*Paired 't' test, P<0.05–significant

Table 2 Comparison of mean PII at baseline & after 10 days of hiora use in phase II

Parameter	N	Baseline		After 10 days		Reduction		'p' value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	0.54	0.20	0.41	0.18	0.13	0.17	<0.001

*Paired 't' test, P<0.05–significant

Table 3 Comparison of mean PII at baseline & after 10 days of hiora use in phase III

Parameter	N	Baseline		After 10 days		Reduction		'p' Value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	0.48	0.09	0.27	0.05	0.21	0.06	<0.001

*Paired 't' test, P<0.05–significant

Table 4 Comparison of mean pli at baseline & after 10 days of chlorhexidine use in phase I

Parameter	N	Baseline		After 10 days		Reduction		'p' value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	0.50	0.17	0. 24	0.07	0.26	0.12	<0.001

*Paired 't' test, P<0.05–significant

Table 5 Comparison of mean pli at baseline & after 10 days of chlorhexidine use in phase II

Parameter	N	Baseline		After 10 days		Reduction		'p' value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	1.23	0.44	0.57	0.32	0.66	0.23	<0.001

*Paired 't' test, P<0.05–significant

Table 6 Comparison of mean PII at baseline & after 10 days of chlorhexidine use in phase III

Parameter	N	Baseline		After 10 days		Reduction		'p' Value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	0.76	0.29	0.44	0.19	0.32	0.26	<0.001

*Paired 't' test, P<0.05–significant

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Table 7 Comparison of mean PII at baseline & after 10 days of 10% terminalia chebula use in phase I

Parameter	N	Baseline		After 10 days		Reduction		'p' value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	0.88	0.35	0.52	0.20	0.36	0.25	<0.001

*Paired 't' test, P<0.05 – significant

Table 8 Comparison of mean PII at baseline & after 10 days of 10% terminalia chebula use in phase II

Parameter	N	Baseline		After 10 days		Reduction		'p' value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	0.49	0.15	0.30	0.06	0.19	0.16	<0.001

*Paired 't' test, P<0.05–significant

Table 9 Comparison of mean PII at baseline & after 10 days of 10% terminalia chebula use in phase III

Parameter	N	Baseline		After 10 days		Reduction		'p' value*
		Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	Mean	Std. Dev.(±)	
PLI	24	0.99	0.46	0.65	0.35	0.34	0.22	<0.001

*Paired 't' test, P<0.05–significant

Discussion

The results observed regarding plaque reduction after using Hiora mouthwash can be attributed to the presence of Piper betel which in itself has plaque inhibiting property. The findings of present study are in accordance with a study by Anup N et al.,[12] who also demonstrated the efficacy of Hiora in reducing the plaque. Studies by Narayan A et al.[13] & Bhate D et al.[14] have also reported the efficacy of Hiora as a plaque reducing agent. In contrast to present study, Southern EN et al.[15] have demonstrated Hiora to be ineffective compared to a placebo in relation to plaque reduction. A study done by Nagesh Bhat et al.[16] showed that Chlorhexidine was more effective compare to herbal mouthwash. Herbal mouthwash in reducing plaque is quite effective as Chlorhexidine and considered as a good alternative. The Chlorhexidine mouthwash was reported with many side effects which limits its acceptability and long-term use, whereas the presently tested herbal mouthwash had no side effects apart from mild burning sensation. The present study attributed to substantivity property of Chlorhexidine for 12hours which is considered to be highly effective, whereas the substantivity of herbal mouth rinse is yet to be established. The findings of our study can be correlated with the findings of Bhate D et al.[14] & Bagchi et al.[17] who demonstrated Chlorhexidine to be a highly acceptable antiplaque agent. The findings of our study can be attributed to the presence of *Terminalia chebula* mouthwash to reduce plaque deposition in addition to its inhibition.[18] The results of the present study are similar to the studies carried out by Surya Prakash DV et al.[19] and Nayak SS et al.[20] who also demonstrated *Terminalia chebula* to be effective in reducing plaque. Presence of tannin which is present to an extent of 30-40 % may have induced cytotoxic action on the cell membranes of the microorganism. A study done by Gautam Biswas et al.[21] showed a significant reduction in Plaque scores from baseline to 1st week, 2nd week and at 4th week in both chlorhexidine and herbal mouthwash. But the improvement in plaque index scores were found better in Chlorhexidine group compare to herbal mouthwash group.

Summary & conclusion

With the advancement in the field of dentistry, various preventive measures have emerged targeting the causative factors of the oral diseases. Plaque accumulation is one such factor which predisposes an individual to both dental caries and periodontal disease. Based on the overall mean reduction observed in relation to plaque index, Chlorhexidine showed maximum reduction followed by *Terminalia chebula*, and Hiora. Comparison of overall mean reduction recorded, showed it to be statistically significant between Chlorhexidine and Hiora, and Chlorhexidine and *Terminalia Chebula*, while the same was statistically not significant between Hiora and *Terminalia Chebula*. Further studies with varied concentrations, different parameters and larger sample size are to be carried out to assess its efficacy, dosage, and toxicity before they are considered as a meaningful and cost effective addition to mechanical oral hygiene methods.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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