

A Comparative Clinical Study to Evaluate the Effect of 1.5% Hydrogen Peroxide Mouthwash as an Adjunct to 0.2% Chlorhexidine Mouthwash to Reduce Dental Stains and Plaque Formation

Ravi Prabhu¹, Bhagyashree Kohale², Amit A. Agrawal³, Shreeprasad Vijay Wagle⁴, Goovind Bhartiya⁴, Dipali Chaudhari⁴

ABSTRACT

Introduction: Chlorhexidine mouthwash is known to be the gold standard to control plaque and gingivitis. However, the side effect of stains has restricted its long term use. Oxidizing agent such as hydrogen peroxide is an effective stain remover, both in-vitro and in-vivo and have also been used as an effective plaque control agent and in patients with NUG without any harmful effects. If H₂O₂ mouthwash could reduce the stains produced by Chlorhexidine and simultaneously improve plaque control, then patients' compliance will be much better.

Material and methods: The present single blind, parallel design study was conducted on 30 patients with generalized marginal gingivitis that were divided into three groups of 10 subjects each. All patients underwent oral prophylaxis at baseline and were randomly allocated to one of the three groups. Group 1: rinsed with Chlorhexidine 0.2%, Group 2: rinsed with Chlorhexidine 0.2% followed by hydrogen peroxide mouthwash 1.5%; Group 3: rinsed with hydrogen peroxide 1.5% mouthwash followed by Chlorhexidine mouthwash 0.2%. Examination for plaque and stains was done at the end of 1st, 2nd and 3rd weeks during the 21 days study period.

Results: Group 2 has given results that there was less stain intensity when compared with group 1 after 14 and 21 days. The relative area of stained surfaces was less in the group 2 than in the group 1 and group 3 at the end of 1 week. The plaque formation was significantly less in groups 2 and 3 than group 1 at 7, 14 and 21 days.

Conclusion: The use of hydrogen peroxide as adjunct to Chlorhexidine proved to be more effective than the Chlorhexidine alone in regard to the reduction of plaque and stains formation.

Keywords: hydrogen peroxide, Chlorhexidine, plaque control.

most common and widely used method for plaque control. Personal mechanical oral hygiene measures includes the toothbrush and interproximal devices.²

Chemical plaque control measures are used for the prevention of dental plaque formation, they are available in the form of dentifrices, mouthwash etc. In present, mechanical plaque control is the most commonly used method for supra-gingival plaque control.³ It is difficult to achieve plaque control over long periods of time by use of these mechanical plaque control devices.⁴ More awareness and counselling is required for these devices to be used by patients⁵. Mechanical tooth cleaning is also a time-consuming procedure. As known, long-standing gingivitis increases the risk of attachment loss and may increase the prevalence of mild to moderate periodontitis. In this regard chemotherapeutic agents such as mouth rinses are a common adjunct to mechanical hygiene measures to facilitate the control of supra-gingival plaque and gingivitis.^{6,7}

Chlorhexidine has specific property known as substantivity, because of which it has remained the gold standard for chemical plaque control agent.⁸ Use 18-20 mg dose rinsed for 60 seconds twice daily, derived from 0.12% or 0.2% formulation of Chlorhexidine. Chlorhexidine digluconate is most effective agent in numerous studies^{9,10} and it is still examined, either combined with other ingredients or as a positive control.¹¹⁻¹⁴

Chlorhexidine has a wide spectrum of activity encompassing gram-positive and gram-negative bacteria, yeasts, dermatophytes and some lipophilic viruses.¹⁵ Daily rinsing with CHLORHEXIDINE is not promoted because it causes dental stains and taste disturbances therefore persistent use

¹Post Graduate Student, ²Consultant Periodontist, ³Professor, Department of Periodontology and Implantology, MGV's KBH Dental College, ⁴Post Graduate Student, Department of Periodontology and Implantology, MGV's KBH Dental, Nashik, Maharashtra, India

Corresponding author: Dr Shreeprasad Vijay Wagle, Anand Nagar, Lashkarwadi, At post: Jalgaon, Tal: Dapoli, Dist: Ratnagiri, Pin Code: 415712, Maharashtra, India

How to cite this article: Ravi Prabhu, Bhagyashree Kohale, Amit A. Agrawal, Shreeprasad Vijay Wagle, Goovind Bhartiya, Dipali Chaudhari. A comparative clinical study to evaluate the effect of 1.5% hydrogen peroxide mouthwash as an adjunct to 0.2% chlorhexidine mouthwash to reduce dental stains and plaque formation. International Journal of Contemporary Medical Research 2017;4(10):2181-2184.

INTRODUCTION

If left untreated, plaque-associated periodontal diseases may progress over time and eventually, involve and compromise the entire periodontal attachment apparatus.¹ There are various methods of plaque control mechanical and chemical plaque control are the most common and effective methods of plaque control. Plaque should be removed to prevent periodontal diseases. And this has explained very well by Loe(1965) and Axelsson et al.(1991). Personal and professional mechanical oral hygiene measures are the

of CHLORHEXIDINE cannot be advise. If stain formation could be reduced patient compliance may increase.

There is a concept of supragingival plaque control by the use of oxygenating agents that are employed the treatment of some conditions like acute ulcerative gingivitis without any side effects.¹⁶ Hydrogen peroxide (H₂O₂) 1.5% is a good chemical known for stain removing capability. Hydrogen peroxide (H₂O₂) removes stain by the action of oxygen release, mechanical cleansing actions and redox reactions. Free radicals released by hydrogen peroxide break the electron-rich alkene double bonds which are responsible for discoloration, which ultimately causes removal of stain. To evaluate the efficacy of hydrogen peroxide used as an adjunct to Chlorhexidine for the purpose of reducing the formation stains and plaque. The aim of this study was to evaluate the efficacy of hydrogen peroxide used as an adjunct to Chlorhexidine for the purpose of reducing the formation stains and plaque.

MATERIAL AND METHODS

Ethical clearance was obtained from the ethics committee. This single blind, parallel design study was conducted in the department of Periodontology and Implantology, MGV's Dental College, Nashik, India over a period of 21 days. Patients who were systemically healthy with no history of smoking having minimum of 24 teeth present, and no pockets >5 mm present also no antibiotics intake for last 3 months were included in the study. However patient who had fixed or removable orthodontic appliance or prosthesis, had known allergy to Chlorhexidine or hydrogen peroxide, and pregnant females were excluded. A total of 30 patients who met the criteria participated in the study, out of which 18 were females and 12 were males. The patients were informed about the study in the local language and a written consent was obtained. Scaling and polishing was done for the subjects at baseline. Demonstration of Bass method of tooth brushing were given to the subjects and they were asked to a soft toothbrush and commercially available toothpaste prior to rinsing.

The selected patients were randomly divided into three groups; each group consist of 10 patients. Group 1 was asked to rinse with 0.2% Chlorhexidine twice daily for 1 min for 3 weeks after 30min of brushing.¹⁷ Group 2 was asked to rinse with 0.2% Chlorhexidine followed by 1.5% H₂O₂ twice daily for 1 min for 3 weeks after 30 min of brushing. Group 3 was asked to rinse with 1.5% H₂O₂ for 1 min followed by 0.2% Chlorhexidine for 1 min twice daily for 3 weeks after 30 min of brushing. Post the end of first, second and third week the patients were asked to report to the department for the evaluation, to check the compliance and to issue more mouthwash if required.

Clinical examination

At each follow-up visits, patient's plaque scores and stains score were recorded. Clinical examination was done with the help of mouth mirror, UNC15 periodontal probe and 17/23 explorer. To assess stain area and intensity Lobene modified index modified was used.¹⁸ Criteria for the index

is as follows Intensity of stain 0 means No stain present, 1 means faint stain, 2 means clearly visible stain that may be orange to brown, 3 means dark stain that may be deep brown to black. Stain area 1 means thin line that can be continuous, 2 means thick line or band, 3 means covering the total area. For assessment of plaque formation Turesky modification of the Quigley-Hein plaque index was used.¹⁹ An erythroline dye containing disclosing agent was used to make plaque visible and easier to score on a numerical scale. Criteria for scoring was like 0 means No plaque, 1 means flecks of plaque at the cervical area, 2 means thin, continuous band of plaque up to 1 mm at the cervical area, 3 means band of plaque wider than 1 mm but covering less than one-third of the crown, 4 means plaque covering at least one-third but less than two-thirds of the crown portion and last 5 means plaque covering two-thirds or more of the crown portion.

STATISTICAL ANALYSIS

First of all mean of the entire group scores were calculated for stain intensity, stain area, and plaque. Paired t test was applied for intra-group comparison,. Inter-group comparison was made using general linear model, and multiple comparison test. P value was ≤ 0.05 considered significant whereas ≤ 0.001 was considered highly significant.

RESULTS

For evaluation of stains and plaque scores, 30 subjects were examined. Mean scores for each group comprising of 10 subjects were calculated at the end of 1st, 2nd, and 3rd week. In group 1 there was significant increase in mean plaque score at the end of 2 weeks when compared with scores at the end of 1 week. Further increase in plaque scores at the end of 3 weeks when compared with scores at 2 weeks was seen (Table 1). The increase ($p \leq 0.0001$) was significant in group 1 and group 3. Table I demonstrates the comparisons of mean stain intensity scores between the 3 groups. At the end of 2nd and 3rd week, in comparison to group 1, there was a significantly decrease with mean stain intensity in group 2. Group 2 also had fewer amounts of stains than group 3 after 2nd and 3rd week but it showed non-significant difference. In group 3 mean stain intensity was seen less after 1, 2, and 3 weeks when compared with group 1 but statistical result was non-significant. Table I shows the mean stain area between the 3 groups at the end of 1, 2, and 3 week. The mean stain area recorded was increased over 2 and 3 weeks and was highest in case of group 1. This was followed by group 3 and last group 2.

DISCUSSION

Chlorhexidine is a cationic bisbiguanide and antimicrobial agent that has broad spectrum antibacterial activity, low tissue toxicity and has strong affinity towards skin and mucous membrane for binding.¹⁵ Interestingly, and critically, Chlorhexidine shows different effects at different concentrations; at low concentrations the agent is bacteriostatic, whereas at higher concentrations the agent is rapidly bactericidal. The actual levels at which the bacteriostatic and bactericidal effects manifest themselves vary between species

Plaque	Week	Groups			Paired T test (Inter group) P value		
		1	2	3	1/2	1/3	2/3
	1 st week	0.50±0.16	0.14±0.13	0.49±0.15	0.002	0.004	0.048
	2 nd week	0.65±0.19	0.52±0.13	0.71±0.20	0.002	0.014	0.003
	3 rd week	1.01±0.16	0.52±0.18	0.95±0.21	0.001	0.103	0.003
Intra group	1 st / 2 nd	0.001	0.355	0.058			
	1 st / 3 rd	0.000	0.382	0.033			
	2 nd / 3 rd	0.000	0.765	0.037			
Stain intensity							
		1	2	3	1/2	1/3	2/3
	1 st week	0.15±0.14	0.16±0.59	0.03±0.49	0.121	0.441	0.041
	2 nd week	0.12±0.10	0.18±0.17	0.59±0.19	0.024	0.359	0.173
	3 rd week	0.21±0.17	0.63±0.20	1.03±0.24	0.003	0.071	0.298
Intra group	1 st / 2 nd	0.002	0.025	0.268			
	1 st / 3 rd	0.008	0.001	0.026			
	2 nd / 3 rd	0.048	0.005	0.388			
Stain area							
		1	2	3	1/2	1/3	1/3
	1 st week	0.10±0.10	0.09±0.08	0.18±0.18	0.012	0.522	0.043
	2 nd week	0.88±0.19	0.20±0.20	0.73±0.16	0.052	0.892	0.088
	3 rd week	1.59±0.19	0.63±0.20	1.33±0.17	0.051	0.542	0.179
Intra group	1 st / 2 nd	0.004	0.032	0.028			
	1 st / 3 rd	0.038	0.028	0.278			
	2 nd / 3 rd	0.040	0.013	0.311			

Table-1: Inter and Intra group comparison of Stains and plaque score.

to species.

Chemical plaque control methods has various agents that has positive effects which makes it best adjunct to mechanical methods.²⁰ Chlorhexidine has become gold standard in potential antiplaque agents. But Chlorhexidine has some side effects like extrinsic staining and taste aberrations. They limit its long-term use for chemical plaque control.

The present study aimed to investigate the efficacy of 1.5% hydrogen peroxide mouthwash as an adjunct to 0.2% Chlorhexidine mouthwash for the purpose of reducing stains and plaque.

The results of the present study show a tendency toward less stain development when chlorhexidine is used with H₂O₂ as compared to using it alone, as shown in Tables 1. The intensity of stains was less significantly in group 2 when compared with group 1 at the end of 2nd week. At the end of 1st week, group 2 showed significantly less stain intensity when compared with group 3; Hence it notifies that Chlorhexidine + H₂O₂ group was more effective than those H₂O₂ + Chlorhexidine group. According to study done by Eriksen et al.²¹ this finding can be supported. That was a double-blinded experimental study where combination of 0.2% chlorhexidine and 1% peroxymonosulfate solution was used. Results came as marked reduction in extrinsic tooth discoloration with maintained plaque preventive. Similar results were seen in the study done by Grundemann et al.²², where combination of chlorhexidine and peroxyborate shown less stains than Chlorhexidine alone.

Eriksen et al. indicated that Chlorhexidine treatment alters the incorporation into plaque of natural sulphur containing organic component of saliva or bacteria. It readily interacts

with transition metals, particularly iron, producing stained material. Both ferric and stannic sulphides are strongly coloured. These colours thus correlate well with clinically observed extrinsic discolorations. When it becomes more oxidized, those sulphide compounds convert into sulphates that are generally greyish or white and become soluble. This is the reason for inhibition of staining when oxidizing solution rinsing was done. Present study has compared three different groups 1st was after brushing rinsing twice daily with Chlorhexidine 0.2%, Chlorhexidine 0.2% followed by hydrogen peroxide 1.5% and hydrogen peroxide followed by Chlorhexidine 0.2%. There was significant difference in mean plaque scores of group 2 and group 3 at the end of 1st and 2nd weeks when compared with group 1, where score of group 1 and 2 was less. Values are shown in Table 1. At the end of 3rd week, there was a non-significant difference in plaque scores between group 1 and group 3; where group 3 was better of the remaining two groups. However, in group II, the plaque score was significantly less compared to remaining two groups.

Present study showed that efficiency of 0.2% Chlorhexidine to inhibit supragingival plaque does not disturbs when it is used along with hydrogen peroxide solution. Whereas it shows rinsing with Chlorhexidine with hydrogen peroxide combination even enhances chemical plaque control. This can be stated as, combination of chlorhexidine and hydrogen peroxide has better additive effect as both chemicals have a their own different effects with regards to bacterial killing. In regards to antiplaque mouth rinse, the mechanism of action of Chlorhexidine is limited to topical only. Seymour and Heasman in 1992 reported that bactericidal effect is

related to the cell wall access. The potent action of hydrogen peroxide is due to release of oxygen that kills the obligate anaerobes causative of oral infections.

CONCLUSION

From all the above results and discussion we can conclude that combine use of 0.2% chlorhexidine along with 1.5% hydrogen peroxide has better effect than 0.2% chlorhexidine mouthwash alone. Rinsing twice daily with 0.2% chlorhexidine and 1.5% hydrogen peroxide can be safely prescribed to reduce extrinsic tooth discoloration without disturbing the plaque inhibiting action of 0.2% chlorhexidine. 0.2% chlorhexidine when used along with 1.5% hydrogen peroxide enhances the effect of 0.2% Chlorhexidine in reducing plaque formation.

REFERENCES

- Guarnelli ME, Zangari F, Manfrini R, Scapoli C, Trombelli L. Evaluation of additional amine fluoride/stannous fluoride containing mouthrinse during supportive therapy in patients with generalized aggressive periodontitis. A randomized, crossover, double-blind, controlled trial. *J Clin Periodontol* 2004;31:742-8.
- Axelsson P, Lindhe J, Nyström B. On the prevention of caries and periodontal disease. Results of a 15-year longitudinal study in adults. *J Clin Periodontol* 1991;18:182-9.
- Francesso AG, Sampathkumar P, Beatrice E. Microbiological and clinical effects of Chlorhexidine digluconate and hydrogen peroxide mouthrinse on developing plaque and gingivitis. *J Clin Periodontol* 1988;15:60-7.
- Lindhe J, Westfelt E, Nyman S, Socransky SS, Haffajee AD. Long-term effect of surgical/non-surgical treatment of periodontal disease. *J Clin Periodontol* 1984;11:448-58.
- Wilson TG Jr. Compliance. A review of the literature with possible applications to periodontics. *J Periodontol* 1987;58:706-14.
- Brex M. Strategies and agents in supragingival chemical plaque control. *Periodontol* 2000 1997;15:100-8.
- Jackson RJ. Metal salts, essential oils and phenols - Old or new? *Periodontol* 2000 1997;15:63-73.
- Claydon N, Addy M, Jackson R, Smith S, Newcombe RG. Studies on the effect of polyvinyl pyrrolidone on the activity of Chlorhexidine mouthrinses: Plaque and stain. *J Clin Periodontol* 2001;28:558-64.
- Lang NP, Brex M. Chlorhexidine digluconate: An agent for chemical plaque control and preventions. *J Periodontal Res* 1986;21 Suppl 16:74-89.
- Addy M, Moran J, Wade W. Chemical plaque control in the prevention of gingivitis and periodontitis. In: Lang NP, Karring T, editors. *Proceedings of the 1st European Workshop on Periodontology*. London: Quintessence Publishing; 1994. p. 244-57.
- Auschill TM, Hein N, Hellwig E, Follo M, Sculean A, Arweiler NB. Effect of two antimicrobial agents on early in situ biofilm formation. *J Clin Periodontol* 2005;32:147-52.
- Claydon NC, Addy M, Newcombe R, Moran J. The prevention of plaque re-growth by toothpastes and solutions containing block copolymers with and without polypeptide. *J Clin Periodontol* 2005;32:545-8.
- Quirynen M, Soers C, Desnyder M, Dekeyser C, Pauwels M, van Steenberghe D. A 0.05% cetyl pyridinium chloride/0.05% Chlorhexidine mouth rinse during maintenance phase after initial periodontal therapy. *J Clin Periodontol* 2005;32:390-400.
- Jones CG. Chlorhexidine: Is it still the gold standard? *Periodontol* 2000 1997;15:55-62.
- Denton GW. Chlorhexidine. In: Block SS, ed. *Disinfection, Sterilization and preservation*. 4th edn. Philadelphia: Lea and Febiger, 1991: 274-289.
- Donna BL, Grundeman LJ, Steinfors J, Timmerman MF, van der Weijden GA. The inhibitory effect of combining Chlorhexidine and hydrogen peroxide on 3 day plaque accumulation. *J Clin Periodontol* 1998;25:879-83.
- Paraskevas S, Danser MM, Timmerman MF, Van der Velden U, Van der Weijden GA. Optimal rinsing time of intra-oral distribution (spread) of mouthwashes. *J Clin Periodontol* 2005;32:665-9.
- Macpherson LM, Stephen KW, Joiner A, Schafer F, Huntington E. Comparison of a conventional and modified tooth stain index. *J Clin Periodontol* 2000;27:854-9.
- Turesky S, Gilmore N, Glickman I. Reduced plaque formation by chloromethyl analogue of Vitamin C. *J Periodontol* 1970;41:41-3.
- Wu CD, Savitt ED. Evaluation of the safety and efficacy of over-the-counter oral hygiene products for the reduction and control of plaque and gingivitis. *Periodontol* 2000 2002;28:91-105.
- Eriksen HM, Solheim H, Nordbø H. Chemical plaque control and prevention of extrinsic tooth discoloration in vivo. *Acta Odontol Scand* 1983;41:87-91.
- Grundeman LJ, Timmerman MF. Stain and plaque reduction by combining Chlorhexidine and perborate. *J Clin Periodontol* 2000;27:9-15.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 10-10-2017; **Accepted:** 09-11-2017; **Published:** 20-11-2017