

A CASE-CONTROL STUDY TO ASSESS AND COMPARE THE EFFICACY OF 0.2% CHLORHEXIDINE AND 0.25% SODIUM HYPOCHLORITE MOUTHWASH IN TREATMENT OF CHRONIC GINGIVITIS

KAAVYA SHANKER¹, GIRISH SURAGIMATH^{1*}, SAMEER A ZOPE¹, SIDDHARTHA A VARMA¹, ASHWINIRANI SR²

¹Department of Periodontology, School of Dental Sciences, KIMSUDU, Karad, Maharashtra, India. ²Department of Oral Medicine and Radiology, School of Dental Sciences, KIMSUDU, Karad, Maharashtra, India. Email: drgirishsuragimath@gmail.com

Received: 23 December 2017, Revised and Accepted: 02 February 2018

ABSTRACT

Objective: The objective of present study was to compare the efficacy of 0.2% chlorhexidine and 0.25% sodium hypochlorite as a mouthwash in controlling chronic gingivitis.

Methods: A total of 80 patients suffering from chronic marginal gingivitis were recruited for the study. Non-surgical periodontal therapy was completed for all the patients to bring the gingival status to healthy levels. The patients were divided into two study groups with 40 patients in each group, Group A patients were asked to use 0.2% chlorhexidine mouthwash, and Group B patients used 0.25% sodium hypochlorite mouthwash as an adjunct to brushing twice daily for 2 weeks. After a period of 2 weeks, the gingival status was recorded using the oral hygiene index simplified (OHIS), plaque index (PI), and modified gingival index (MGI) and compared between the two groups.

Results: The mean OHIS score for Group A was 1.38 and for Group B it was 1.05. The mean PI for Group A and B was 3.62 and 2.32, respectively. The mean MGI score for Group A was 1.22 and for Group B was 1.20. Group B showed better results than Group A. Intergroup comparison of OHIS and PI revealed significantly better results in Group B than Group A while MGI did not show any statistical difference on comparison.

Conclusion: Nearly 0.25% sodium hypochlorite was more effective than 0.2% chlorhexidine in reducing the gingival inflammation. Thus, 0.25% sodium hypochlorite may represent an efficacious, safe and affordable antimicrobial agent in the prevention and treatment of gingival disease.

Keywords: Chlorhexidine, Dental plaque, Mouthwash, Sodium hypochlorite, Gingivitis.

© 2018 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>) DOI: <http://dx.doi.org/10.22159/ajpcr.2018.v11i5.24397>

INTRODUCTION

Gingivitis denotes inflammation of gingiva; if untreated it can lead to periodontitis and destruction of tooth-supporting structures, ultimately leading to tooth loss. The prevalence of gingivitis in the general population is almost 80-90% [1]. The etiology of gingivitis is microbial organisms embedded in a biofilm, i.e. plaque which gets attached to the tooth as well as restorations in the oral cavity. Regular removal of bacterial biofilm helps to maintain gingival health and prevents progression of gingivitis to periodontitis. Various mechanical and chemical plaque control measures are routinely used for plaque removal by the patients as a part of home care measures. Daily mechanical removal of the plaque biofilm by the patient, including the use of an appropriate antimicrobial agent is the only practical means for improving oral health on a long-term basis. Mouthwash, mouthrinse or mouth bath is a liquid that is held in the mouth passively or swirled around the mouth by contraction of perioral muscles or movement of the head and gargled [1]. Chemical inhibitors of plaque biofilm and calculus that are incorporated in mouthwashes play a role in controlling microbial biofilms. Mouthwashes have been used since centuries to reduce the plaque formation and mask halitosis. The American Dental Association advocates the use of mouthwash with mechanical plaque control in maintaining good oral health [2].

Chlorhexidine is a diguanidohexane with pronounced antiseptic properties. Approximately 30% of the chlorhexidine applied is retained in the oral soft tissues, which serve as a reservoir for slow release of the agent over extended periods of time (substantivity) [1]. Chlorhexidine is considered as a gold standard in chemical plaque control. However,

chlorhexidine has various side effects like it cannot be used on a long-term basis as it causes brownish discoloration on the teeth and altered taste sensation [1].

Sodium hypochlorite is a sodium salt of hypochlorous acid with a chemical formula NaClO, when dissolved in water, it is commonly known as bleach or liquid bleach. Sodium hypochlorite is frequently used as a disinfectant or bleaching agent [3]. It has been used in recent times in various concentrations as mouthwash and has shown promising results [4]. It has a broad-spectrum antimicrobial activity which is widely used in health-care facilities. It is an effective and easily available agent for prophylactic use as a mouthwash for cases of gingivitis. If sodium hypochlorite is found to be as effective as chlorhexidine mouthwash, it will ultimately help the general population of developing countries like India in reducing the cost of treatment for gingivitis. However, there is sparse literature available on this topic; therefore, the present study was designed to compare the effects of sodium hypochlorite and chlorhexidine mouthwashes in treating chronic gingivitis patients. This is the first study in an extant medical literature where the efficacy of 0.25% sodium hypochlorite is compared with gold standard antiplaque agent chlorhexidine.

METHODS

The present case-control study was undertaken at the Department of Periodontology, School of Dental Sciences, KIMSUDU, Karad, after due approval from the Ethical Committee (KIMSUDU/IEC/03/2015 Dated: 10/12/2015). The study was conducted during the period from March 2016 to November 2016 and was in accordance with ethical standards outlined in the 1964 Declaration of Helsinki as revised in 2013.

Patients were educated about the objectives of the study, and informed consent was obtained before enrolling them into the study. Patients with a positive history of HIV, AIDS, and patients with any systemic disorders, patients with tobacco usage in smoked or smokeless form were excluded from the study.

Initially, 100 patients with chronic marginal gingivitis were considered for the study. 20 patients who did not report to follow-up after oral prophylaxis were not included in the study. A total of 80 patients completed the 2-week course of the study and reported back to the clinic for the follow-up check. The results of these 80 patients were then subjected for the statistical analysis.

A single trained dentist (KS) carried out complete oral prophylaxis on all the study participants, to bring their gingival status to healthy levels. The participants were educated about the Modified Bass brushing technique [5], and they were asked to maintain good oral hygiene during the study period. The study participants were randomly divided into two groups by flip of a coin method. Group A was asked to use 0.2% chlorhexidine mouthwash (Hexidine®-ICPA Health Products Ltd., Mumbai, India), Group B was asked to use 0.25% sodium hypochlorite mouthwash (Clorox®-The Clorox Company, USA) as an adjunct to brushing twice daily for 2 weeks.

The commercially available sodium hypochlorite (Clorox® 5.25%) was procured from the market, and it was diluted in distilled water at the ratio of 1:20. One teaspoonful of bleach (5 mL) was diluted with one half-glass (120 mL) of distilled water to yield a sodium hypochlorite concentration of 0.25%. This was dispensed using plastic containers to each participant. Patients were asked to brush their teeth thoroughly 30 min before usage of mouthwash.

Instructions for the use of mouthwash

Each participant was asked to swish 15 mL of the mouthwash twice daily for 30 s after tooth brushing and not eat or drink anything for half an hour after mouthwash use. The patients were then asked to report to the clinic after 2 weeks.

A trained examiner, who had no knowledge of the type of mouthwash each participant used, was asked to evaluate the gingival findings for each participant. The gingival status of each study participant was recorded using the oral hygiene index simplified (OHIS) (John C. Greene, 1960) [6], plaque index (PI) (Tureskey-Gilmore-Glickman Modification Quigley Hein PI, 1970) [7] and the gingival index (GI) (modified GI [MGI]- Lobene *et al.*, 1986) [8]. Apart from the periodontal parameters, the socioeconomic status and the education level of each participant were also recorded using the modified Kuppaswamy's scale [9].

All the data collected were statistically analyzed with the help of Statistical Package for the Social Sciences version 19 (IBM Corporation, Armonk, New York, USA). The results were expressed in means and percentages, $p \leq 0.05$ was considered significant.

RESULTS

The demographic data of the study population is elaborated in Table 1. In Group A, the average age was 30.88 ± 10.82 years, and in Group B, the average age was 32.85 ± 16.28 years. Maximum patients in both groups were graduates or postgraduates. All patients from both groups had an annual income of $\geq 36,997$. Hence, there was no major difference in the socioeconomic status of the study participants of Group A and B [7].

The mean OHIS index score for Group A (1.38) was much more than the mean score for Group B (1.05). The mean PI scores for Group A and B were 3.62 and 2.32, respectively. The mean score for the MGI of Group A was 1.22, and the score for Group B was 1.20. On intergroup comparison, OHIS and the PI showed statistically significant differences. However, for MGI, there were no statistical differences observed (Table 2).

Table 1: Demographic table showing age, education level, and socioeconomic status

Parameters	A (n=40)	B (n=40)
Age	30.88±10.82	32.85±16.28
Educational level		
Profession or honors	0	16
Graduate or postgraduate	32	20
Post high school diploma	0	0
High school certificate	3	2
Middle school certificate	5	2
Primary school certificate	0	0
Illiterate	0	0
Socioeconomic status		
$\geq 36,997$	40	34
18,498-36,996	0	6
13,874-18,497	0	0
9,249-13,873	0	0
5,547-9,248	0	0
1,866-5,546	0	0
$\leq 1,865$	0	0

Table 2: Intergroup comparison of mean scores of OHIS, PI, and MGI using student's t-test

Gingival status	A (n=40)	B (n=40)	p value
OHIS	1.38	1.05	0.0003*
PI	3.62	2.32	<0.0001*
MGI	1.22	1.20	0.7879

*Statistically significant. OHIS: Oral hygiene index simplified, MGI: Modified gingival index, PI: Plaque index

DISCUSSION

All 80 patients completed the 2-week duration of the study and used the mouthwash allotted to them twice a day. No adverse events were reported in any of the study patients, except for minor complaints about the taste of sodium hypochlorite and burning sensation after the use of chlorhexidine. These complaints were similar to those reported by patients in studies conducted by De Nardo *et al.* [10] and Vangipuram *et al.* [11].

The efficacy of chlorhexidine in the prevention of gingivitis is well established [12]. Chlorhexidine significantly improves the effect of normal mechanical oral hygiene procedures [12,13]. Chlorhexidine has a broad spectrum of antibacterial activity, in low concentrations, it acts as a bacteriostatic agent, and in high concentrations it acts as a bactericidal agent. In low concentrations, the cationic molecules of chlorhexidine bind readily to the oppositely charged cell wall and interfere with membrane transport initiating a leakage of low molecular weight substances. In high concentrations, it penetrates the cell wall and causes precipitation of the cytoplasm.

Only a few periodontal studies have been conducted on the clinical efficacy of dilute sodium hypochlorite as mouthwash. Sodium hypochlorite causes biosynthetic alterations in cellular metabolism and phospholipid destruction, formation of chloramines that interfere with cellular metabolism [14]. Hypochlorous acid is a powerful oxidant that interacts with most cellular macromolecules, such as nucleotides and lipids and causes DNA and RNA damage [15]. Fatty acid degradation forms glycerol, which reduces the surface tension of the solution and causes plaque inhibition [14,16].

Long-term use of chlorhexidine causes extrinsic brownish staining of teeth, burning sensation of oral mucosa, impaired taste sensation, parotid swelling due to obstruction of the parotid duct and also has cytotoxic effect on human gingival fibroblasts [17-19]. Hence, chlorhexidine is prescribed on a short-term basis during healing period after routine oral surgical procedures. Sodium hypochlorite can

effectively be prescribed as a chemical plaque control agent for long-term use. There are no side effects reported on the usage of sodium hypochlorite, which gives it a major advantage over chlorhexidine. Sodium hypochlorite can be advised in medically compromised, handicapped and hospitalized patients who suffer from recurrent oral infections [20].

The results of the present study show that subjects who used sodium hypochlorite mouthwash had a significantly better reduction in OHIS and PI scores. These results are in accordance with the study conducted by Galván *et al.* [21]. Similarly; Lobene *et al.* [22] and De Nardo *et al.* [10] reported improvement in gingival status following use of different concentrations of sodium hypochlorite as an irrigant and oral rinse.

Limitations of the study

Small sample size and a short follow-up period of 2 weeks, used to evaluate the efficacy of the mouthwashes in this study are the limitations.

Future prospective

Future studies with larger sample size, longer duration, and microbiological investigations should be conducted to substantiate the results of the present study.

CONCLUSION

Within the limitations of the study, it can be concluded that 0.25% sodium hypochlorite as mouthwash was more efficacious than chlorhexidine in the treatment of chronic gingivitis patients.

AUTHOR'S CONTRIBUTION

All the authors have made substantial contributions to conception and design, and/or acquisition of data, and/or analysis and interpretation of data. All the authors participated in drafting the article or revising it critically for important intellectual content and gave final approval of the version to be submitted and any revised version.

CONFLICTS OF INTEREST

Nil

REFERENCES

1. Newman MG, Takei HH, Carranza FA. Carranza's Clinical Periodontology. Philadelphia: W.B. Saunders Co; 2002.
2. DePaola LG, Spolarich AE. Safety and efficacy of antimicrobial mouthrinses in clinical practice. *J Dent Hyg* 2007;81:1-16.
3. Rutula WA, Weber DJ. Uses of inorganic hypochlorite (bleach) in health care facilities. *Clin Microbiol Rev* 1997;10:597-610.
4. Slots J. Anti-Infective Agents in Periodontal Treatment. Medscape; 2017. Available from: <http://www.medscape.com/viewarticle/749509>. [Last cited on 2017 Dec 14].
5. Poyato-Ferrera M, Segura-Egea JJ, Bullón-Fernández P. Comparison of modified bass technique with normal toothbrushing practices for efficacy in supragingival plaque removal. *Int J Dent Hyg* 2003;1:110-4.
6. Greene JC, Vermillion JR. Oral hygiene index: A method for classifying oral hygiene status. *J Am Dent Assoc* 1960;61:172-9.
7. Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of vitamin C. *J Periodontol* 1970;41:41-3.
8. Lobene RR, Weatherford T, Ross NM, Lamm RA, Menaker L. A modified gingival index for use in clinical trials. *Clin Prev Dent* 1986;8:3-6.
9. Sharma R. Kuppaswamy's socioeconomic status scale-revision for 2011 and formula for real-time updating. *Indian J Pediatr* 2012;79:961-2.
10. De Nardo R, Chiappe V, Gomez M, Ro-Manelli H, Slots J. Effect of 0.05% sodium hypochlorite oral rinse on supragingival biofilm and gingival inflammation. *Int Dent J* 2012;62:208-12.
11. Vangipuram S, Jha A, Bhashyam MJ. Comparative efficacy of *Aloe vera* mouthwash and chlorhexidine on periodontal health: A randomized clinical trial. *Clin Exp Dent* 2016;8:442-7.
12. Adams D, Addy M. Mouthrinses. *Adv Dent Res* 1994;8:291-301.
13. Flötra L, Gjeramo P, Rölla G, Waerhaug J. A 4-month study on the effect of chlorhexidine mouth washes on 50 soldiers. *Scand J Dent Res* 1972;80:10-7.
14. Mohammadi Z. Sodium hypochlorite in endodontics: An update review. *Int Dent J* 2008;58:329-41.
15. Gray MJ, Wholey WY, Jakob U. Bacterial responses to reactive chlorine species. *Annu Rev Microbiol* 2013;67:141-60.
16. Preetha S, James DR. Effect of various irrigants on dental biofilm: A review. *Asian J Pharm Clin Res* 2015;8:13-6.
17. Renuka S, Muralidharan NP. Comparison in benefits of herbal mouthwashes with chlorhexidine Mouthwash: A Review. *Asian J Pharm Clin Res* 2017;10:3-7.
18. Verma UP, Dixit J. Development of a human gingival fibroblast (HGF) cell line for the evaluation of a novel mouthwash from *Azadirachta indica* vis-à-vis Chlorhexidine. *Int J Pharm Pharm Sci* 2012;4:217-21.
19. Eunike MC, Fauziah E, Suharsini M. Antibacterial effects of 0.1% chlorine dioxide on *Actinomyces* sp. As an agent of black stain. *Int J Appl Pharm* 2017;9:79-82.
20. Somayaji SK, Ballal ND, Shobha KL, Mohandas Rao KG. Comparison of antimicrobial efficacy of triphala, *Withania somnifera* and sodium hypochlorite against *Enterococcus faecalis* biofilm-An *in vitro* study. *Int J Pharm Pharm Sci* 2014;6:808-11.
21. Galván M, Gonzalez S, Cohen CL, Alonaizan FA, Chen CT, Rich SK, *et al.* Periodontal effects of 0.25% sodium hypochlorite twice-weekly oral rinse. A pilot study. *J Periodontol* 2014;49:696-702.
22. Lobene RR, Soparkar PM, Hein JW, Quigley GA. A study of the effects of antiseptic agents and a pulsating irrigating device on plaque and gingivitis. *J Periodontol* 1972;43:564-8.