



Comparative Evaluation of Neem Mouthwash on Plaque and Gingivitis: A Double-blind Crossover Study

¹Md Jalaluddin, ²UB Rajasekaran, ³Sam Paul, ⁴RS Dhanya, ⁵CB Sudeep, ⁶VJ Adarsh

ABSTRACT

Aim: The present study aimed at evaluating the impact of neem-containing mouthwash on plaque and gingivitis.

Materials and methods: This randomized, double-blinded, crossover clinical trial included 40 participants aged 18 to 35 years with washout period of 1 week between the crossover phases. A total of 20 participants, each randomly allocated into groups I and II, wherein in the first phase, group I was provided with 0.2% chlorhexidine gluconate and group II with 2% neem mouthwash. After the scores were recorded, 1-week time period was given to the participants to carry over the effects of the mouthwashes and then the second phase of the test was performed. The participants were instructed to use the other mouthwash through the second test phase.

Results: There was a slight reduction of plaque level in the first phase as well as in the second phase. When comparison was made between the groups, no statistically significant difference was seen. Both the groups showed reduction in the gingival index (GI) scores in the first phase, and there was a statistically significant difference in both groups at baseline and after intervention (0.005 and 0.01 respectively). In the second phase, GI scores were reduced in both groups, but there was

a statistically significant difference between the groups only at baseline scores (0.01).

Conclusion: In the present study, it has been concluded that neem mouthwash can be used as an alternative to chlorhexidine mouthwash based on the reduced scores in both the groups.

Clinical significance: Using neem mouthwash in maintaining oral hygiene might have a better impact in prevention as well as pervasiveness of oral diseases as it is cost-effective and easily available.

Keywords: Chlorhexidine gluconate, Gingival index, Gingivitis, Neem mouthwash, Plaque index.

How to cite this article: Jalaluddin M, Rajasekaran UB, Paul S, Dhanya RS, Sudeep CB, Adarsh VJ. Comparative Evaluation of Neem Mouthwash on Plaque and Gingivitis: A Double-blind Crossover Study. *J Contemp Dent Pract* 2017;18(7):567-571.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Periodontal disease is one of the diseases that affects the supporting tissues of the teeth. Poor oral hygiene generally results in gingivitis, which is the mild form of periodontal disease. Gingivitis is characterized by swelling, redness, and bleeding of the gums. Plaque that often forms on the surface of teeth and gums is the main cause of gingivitis.¹

After the advent of antibiotics, reduction of plaque has been the symbol of preventive dentistry, and there is a realization that bacteria are the possible causative agents of major dental diseases, caries, and periodontal disease.² One of the main factors causing periodontal inflammation is bacteria in dental plaque, and therefore, cautious plaque control is very important. Hence, it is important to achieve plaque control by limiting the growth of harmful bacteria as it is not possible to stop oral bacteria causing dental plaque.³

Mechanical plaque control measures are widely used to maintain oral hygiene. It needs high motivation and

¹Department of Periodontics and Oral Implantology, Kalinga Institute of Dental Sciences, Kalinga Institute of Industrial Technology University, Bhubaneswar, Odisha, India

²Department of Orthodontics and Dentofacial Orthopedics, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India

³Department of Orthodontics and Dentofacial Orthopedics Educare Institute of Dental Sciences, Malappuram, Kerala, India

⁴Department of Public Health Dentistry, PSM College of Dental Science & Research, Thrissur, Kerala, India

⁵Department of Public Health Dentistry, Sree Anjaneya Institute of Dental Sciences, Kozhikode, Kerala, India

⁶Department of Conservative Dentistry and Endodontics, Mahe Institute of Dental Sciences, Mahe, Puducherry, India

Corresponding Author: Md Jalaluddin, Department of Periodontics and Oral Implantology, Kalinga Institute of Dental Sciences, Kalinga Institute of Industrial Technology University Bhubaneswar, Odisha, India, e-mail: drjalal79@yahoo.co.in

skill sets to perform well, as mechanical plaque control techniques are time-consuming.⁴

An additional help is required in controlling bacterial plaque which gives the rationale for patients to use antimicrobial mouthwashes to their mechanical oral hygiene regimens. Thus, eliminating a nonspecific plaque or inhibition has been accepted as the practical approach to control dental plaque formation. Different products, such as toothpastes, gels, pastes for application, mouthwash, and lozenges have been available for years.⁵

To prevent and cure plaque formation, mouthwashes are used in dentistry. Currently available mouthwashes are all medicated and effective. Neem (*Azadirachta indica*) has been widely used in the treatment of infections, skin lesions, and in reducing swellings. The neem leaves' antimicrobial properties have long been recognized to be beneficial to the skin and hair. Due to its antiplaque, anticariogenic, and antibacterial effects, it has been widely used in different parts of the world as an oral hygiene tool.^{6,7}

Neem inhibits prostaglandin E and 5-HT, thereby acting as an anti-inflammatory agent. "Azadirachtin" which is known to destroy bacterial cell wall is used for explaining the antibacterial action. The growth of bacteria is hence inhibited and cell death occurs because of the destruction of cell wall by change in osmotic pressure.⁸ Hence, this study was conducted to evaluate the impact of neem-containing mouthwash on plaque and gingivitis.

MATERIALS AND METHODS

Totally, 40 participants were involved in this study. Patients in the age group of 18 to 35 years were recruited from the outpatient Department of Periodontics, Kalinga Institute of Dental Sciences, Bhubaneswar, Odisha, India. Ethical approval was obtained from Kalinga Institute of Dental Sciences, and the participants gave their consent for the same. Inclusion criteria were patients with a minimum of 20 teeth, patients with signs of gingival inflammation, and participants who had not received any periodontal therapy for the past 6 months. Exclusion criteria were participants with advanced periodontal inflammation, medically compromised patients, known hypersensitivity to the mouthrinses, pregnant females and nursing mothers, and participants with orthodontic appliances.

Mouthwash Preparation

Chlorhexidine Mouthwash

0.2% chlorhexidine gluconate mouthwash that is available commercially was used.

Neem Mouthwash

A composition of 100 gm of neem sticks were chopped into tiny pieces and ground into coarse powder in a blender for 2% of neem extracts and stored in containers at room temperature. Nearly 60% of the distillate was collected after heating a mixture of 10 parts of water and neem powder continuously that was soaked in water for 2 to 4 hours. Filtration of the collected distillate was done after cooling and then it was dissolved in 1000 mL distilled water to obtain 2% neem solution.⁹

This randomized, double-blinded, crossover clinical trial included 40 participants aged 18 to 35 years with washout period of 1 week between the cross-over phases. About 20 participants in each group were allocated randomly into group I and group II, wherein group I was provided with 0.2% chlorhexidine gluconate mouthwash and group II with 2% neem mouthwash. Lottery method was done by a person for randomization who was not involved in the study. Later, clinical examination was done using Silness and Loe plaque index (PI) and Loe and Silness gingival index (GI) respectively, by a trained, calibrated single examiner to assess plaque and gingivitis. The participants' plaque and gingival scores were recorded at baseline and after 15 days in both the groups.

During the first test phase, the participants in group I were given 10 mL of the chlorhexidine gluconate mouthwash and instructed to rinse for 1 minute, while participants in group II were asked to rinse using 10 mL of neem mouthwash for 15 days. The scores were recorded in both the groups after 15 days of analysis. After the scores were recorded, 1-week time period was given to the participants to carry over the effects of the mouthwashes and then the second phase of the test was performed. During the second test phase, the participants were instructed to use the opposite mouthwash.

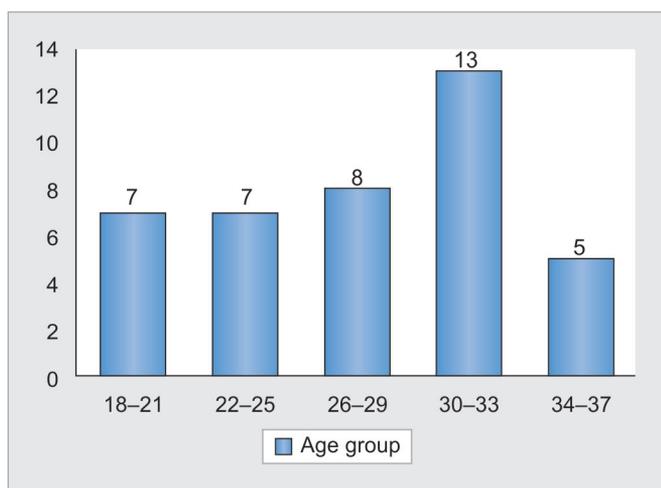
Statistical Analysis

Statistical Package for the Social Sciences software version 17 was used for statistical analysis. The mean and standard deviation of clinical indices were calculated, which was followed by the comparison of the oral examination scores between the two mouthwashes using independent sample t-test. The level of significance was set at 5%.

RESULTS

A total of 40 participants were involved in the study. Participants in the age group of 30 to 33 years were more compared with that of the other age groups (Graph 1).

Tables 1 and 2 reveal the comparison of PI and GI scores before and after intervention. There was



Graph 1: Age distribution

a slight reduction of plaque level in chlorhexidine group (0.565 ± 0.258) compared with neem mouthwash group (0.730 ± 0.359). However, no significant difference was seen statistically between the groups. The GI recordings were reduced in both the groups and

there was a statistically significant difference in both groups at baseline and after intervention (0.005 and 0.01 respectively).

Tables 3 and 4 show the comparison of PI and GI score before and after intervention after crossover phases. There was a slight reduction of plaque level in neem group (0.670 ± 0.301) compared with chlorhexidine mouthwash group (0.750 ± 0.209). However, no statistically significant difference was seen between the groups. The GI recordings were reduced in both the groups, but statistically significant difference was seen between the groups only at baseline scores (0.01).

DISCUSSION

Neem as a mouthwash has effective results on both Gram-positive and Gram-negative organisms that include *Salmonella*, *Escherichia coli*, and *Streptococcus*. For the treatment of periodontitis,¹⁰ extracts of neem that inhibit the growth of *Streptococcus mutans* are used as they contain antioxidant, antiinflammatory, and antimicrobial properties.

Table 1: Comparison of PI score before and after intervention

	Groups	Number of participants	Mean ± SD	Significance (p-value)
Baseline scores	Group I (chlorhexidine)	20	0.950 ± 0.170	0.5
	Group II (neem)	20	0.865 ± 0.181	
After intervention score	Group I (chlorhexidine)	20	0.565 ± 0.258	0.2
	Group II (neem)	20	0.730 ± 0.359	

SD: Standard deviation

Table 2: Comparison of GI score before and after intervention

	Groups	Number of participants	Mean ± SD	Significance (p-value)
Baseline scores	Group I (chlorhexidine)	20	0.485 ± 0.205	0.005*
	Group II (neem)	20	0.495 ± 0.127	
After intervention score	Group I (chlorhexidine)	20	0.225 ± 0.155	0.01*
	Group II (neem)	20	0.340 ± 0.276	

*Statistically significant; SD: Standard deviation

Table 3: Comparison of PI score before and after intervention after crossover

	Groups	Number of participants	Mean ± SD	Significance (p-value)
Baseline scores	Group I (neem)	20	0.875 ± 0.253	0.06
	Group II (chlorhexidine)	20	0.915 ± 0.187	
After intervention score	Group I (neem)	20	0.670 ± 0.301	0.08
	Group II (chlorhexidine)	20	0.750 ± 0.209	

SD: Standard deviation

Table 4: Comparison of GI score before and after intervention after crossover

	Groups	Number of participants	Mean ± SD	Significance (p-value)
Baseline scores	Group I (neem)	20	0.555 ± 0.193	0.01*
	Group II (chlorhexidine)	20	0.610 ± 0.253	
After intervention score	Group I (neem)	20	0.360 ± 0.208	0.4
	Group II (chlorhexidine)	20	0.395 ± 0.248	

*Statistically significant; SD: Standard deviation

Typically, in most parts of the world, a common method for preventing orodental diseases is mechanical removal of plaque. Meanwhile, it is also suggested by few evidences that mechanical cleaning methods are not sufficient.^{11,12} One of the new concepts is chemical antiplaque agents which is gradually developing its roots. To large percentages of even the most affluent and developed societies, wholesale use of more expensive chemical antiplaque formulations would be quite restrictive due to high expense or ignorance.¹³ The World Health Organization has estimated that approximately 65 to 80% population of the world use traditional medicine as the primary form of health care.

Although the discovery of chlorhexidine was done in the early 1950s, it is still well thought-out as the most effective antiplaque agent in dentistry. However, because of its displeasing taste and proclivity to stain the teeth brown, its use is limited.¹⁴

As the taste should not be a hindrance for its use with maximal inhibition of bacteria and plaque, 2% of neem was used in this study. For reducing periodontal that registers as chlorhexidine, neem mouthwash was very effective. The results assured an outstanding decrease in GI scores in both Groups I and II during the 15 days of analysis. According to Botelho et al,¹⁵ *A. indica*-based mouthrinse has high efficacy and it can be used as an alternative treatment for periodontal diseases, which is in accordance with our current study. A reduction in the probing pocket depth and gain in the clinical attachment level by the use of neem extract were reported by Patel and Venkatakrishna-Bhatt.¹⁶

When compared with 0.2% chlorhexidine gluconate mouthwash, neem mouthwash is considered to be cost-effective. Hence, the neem extract can be used as a better alternative mouthwash to 0.2% chlorhexidine gluconate mouthwash in low socioeconomic status population. Chlorhexidine mouthwash showed a higher impact on the reformation of plaque and inflammation of gingiva when compared with that by neem mouthwash. Both chlorhexidine and neem mouthwashes have antigingivitis and plaque-inhibiting properties which was proved by the decrease in the GI and PI scores between groups I and II, postrinsing.

The results of this study were in accordance with the results of a study conducted by Wolinsky et al,⁹ who stated that there was a marked reduction in the bacterial aggregation, growth, adhesion to hydroxyapatite, and production of insoluble glucan that affects the formation of *in vitro* plaque by the use of aqueous extracts of neem, derived from the bark-containing sticks (neem stick) of *A. indica*. In another study conducted by Pai et al,¹⁷ *A. indica* extract showed a significant reduction in the PI

and bacterial count when it was compared with that of 0.2% chlorhexidine, which is similar to the results of the present study.

CONCLUSION

From the present study, it has been concluded that neem mouthwash can be used as an alternative to chlorhexidine mouthwash as the reducing scores are witnessed in both groups I and II. Neem mouthwash might have a better impact in maintaining oral hygiene, prevention as well as pervasiveness of oral diseases as it is cost-effective and easily available.

REFERENCES

1. Aspalli S, Shetty VS, Devarathnamma MV, Nagappa G, Archana D, Parab P. Evaluation of antiplaque and antigingivitis effect of herbal mouthwash in treatment of plaque induced gingivitis: a randomized, clinical trial. *J Indian Soc Periodontol* 2014 Jan;18(1):48-52.
2. Fine DH. Chemical agents to prevent and regulate plaque development. *Periodontology* 2000 1995 Jun;8:87-107.
3. Phatak AA, Patankar RD, Galgatte UC, Paranjape SY, Deshpande AS, Pande AK, Thombre R. Antimicrobial activity of a poly-herbal extract against dental micro flora. *Res J Pharm Biol Chem Sci* 2011;2(2):533-539.
4. Rao NJ, Subhas KR, Kumar KS. Role of phytotherapy in gingivitis: a review. *J Pharmacol* 2012;8:1-5.
5. Kaur RK, Singh MP, Chopra R, Bhatia A. To evaluate the efficacy of three commercially available herbal mouthwashes in treatment of chronic gingivitis: a comparative clinical study. *Int J Dent Med Res* 2014;1(4):42-46.
6. Almas K. The antimicrobial effects of extracts of *Azadirachta indica* (Neem) and *Salvadora persica* (Arak) chewing sticks. *Indian J Dent Res* 1999 Jan-Mar;10(1):23-26.
7. Khalessi AM, Pack AR, Thomson WM, Tompkins GR. An *in vivo* study of the plaque control efficacy of *Persica*: a commercially available herbal mouthwash containing extracts of *Salvadora persica*. *Int Dent J* 2004 Oct;54(5):279-283.
8. Chatterjee A, Saluja M, Singh N, Kandwal A. To evaluate the antigingivitis and antiplaque effect of an *Azadirachta indica* (Neem) mouthrinse on plaque induced gingivitis: a double-blind, randomized, controlled trial. *J Indian Soc Periodontol* 2011 Oct;15(4):398-401.
9. Wolinsky LE, Mania S, Nachnani S, Ling S. The inhibiting effect of aqueous *Azadirachta indica* (Neem) extract upon bacterial properties influencing *in vitro* plaque formation. *J Dent Res* 1996 Feb;75(2):816-822.
10. Kukreja BJ, Dodwad V. Herbal mouthwashes – a gift of nature. *Int J Pharma Bio Sci* 2012 Apr;3(2):46-52.
11. Addy M, Griffiths G, Dummer P, Kingdom A, Shaw WC. The distribution of plaque and gingivitis and the influence of toothbrushing hand in a group of South Wales 11-12 year-old children. *J Clin Periodontol* 1987 Nov;14(10):564-572.
12. De La Rosa M, Zacarias Guerra J, Johnston DA, Radike AW. Plaque growth and removal with daily toothbrushing. *J Periodontol* 1979 Dec;50(12):661-664.

Comparative Evaluation of Neem Mouthwash on Plaque and Gingivitis: A Double-blind Crossover Study

13. Moran JM. Chemical plaque control-prevention for the masses. *Periodontology* 2000 1997 Oct;15:109-117.
14. Fardal O, Turnbull RS. A review of the literature on use of chlorhexidine in dentistry. *J Am Dent Assoc* 1986 Jun;112(6): 863-869.
15. Botelho MA, dos Santos RA, Martins JG, Carvalho CO, Paz MC, Azenha C, Ruela RS, Queiroz DB, Ruela WS, Marinho G, et al. Efficacy of a mouthrinse based on leaves of the neem tree (*Azadirachta indica*) in the treatment of patients with chronic gingivitis: a double-blind, randomized, controlled trial. *J Med Plants Res* 2008 Nov;2(11):341-346.
16. Patel VK, Venkatakrishna-Bhatt H. Folklore therapeutic indigenous plants in periodontal disorders in India (Review, experimental and clinical approach). *Int J Clin Pharmacol Ther Toxicol* 1988 Apr;26(4):176-184.
17. Pai MR, Acharya LD, Udupa N. Evaluation of antiplaque activity of *Azadirachta indica* leaf extract gel – a 6-week clinical study. *J Ethnopharmacol* 2004 Jan;90(1):99-103.