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# RESEARCH ARTICLE

# COMPARATIVE CLINICAL EVALUATION OF 0.2% CHLORHEXIDINE MOUTHWASH WITH AN ANTIDISCOLORATION SYSTEM VERSUS 0.2% CHLORHEXIDINE MOUTHWASH

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**ABSTRACT**

**Aim:** The aim of the study was to determine the plaque and gingivitis reducing effect of a dentifrice containing chlorhexidine and compare with control toothpaste during the course of 3 months. **Materials and Methods:** This randomized, double-blind study looked prospectively at participants over a 3 month period. Plaque score and gingivitis score was assessed in 40 participants, who were divided into two parallel groups. The participants used either chlorhexidine containing toothpaste (test group) or commercially available fluoridated triclosan containing toothpaste (control group). Parameters were assessed at baseline and again after 1and 3 months. **Results:** After 3 months of product use, both groups had less gingivitis compared with the baseline evaluation (p=0.001). At this time point, the test group showed a statistically significant lower gingival index values compared with the baseline (p=0.001). No statistically significant difference between either of the groups at various time points was detected with regard to plaque index score. **Conclusion:** Although there was a statistically significant difference at 3 months between test and control groups in reduction of gingival index values, this difference was too small to be considered clinically meaningful.

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## INTRODUCTION

Dental plaque is the primary etiologic factor of the two most prevalent oral diseases: dental caries and periodontal disease (Page *et al*., 2000) Studies have clearly demonstrated that the ability to control the onset or progression of periodontal diseases is improved by regular plaque-control practices (Axelsson, 1987; Axelsson, 2004) Although data show that oral health can be improved through effective plaque control, mechanical means of cleaning are failing to deliver optimal levels of oral health because the techniques are not done consistently or thoroughly. Yet, these studies have also demonstrated that oral hygiene routines (daily toothbrushing and flossing) are neither practiced consistently nor are they done for an adequate amount of time to thoroughly remove plaque. These limitations on home oralcare practices suggest that other strategies are urgently required. As noted by De Paola *et al*. (1989) mechanical oral hygiene methods of plaque removal require time, motivation, and manual dexterity. Therefore, chemotherapeutics agents can play a pivotal role as adjuncts of mechanical plaque-control methods. As others have suggested, the use of chemotherapeutic agents as adjuncts of mechanical at-home plaque control is recommended (Bouwsma, 1996; Wolff, 1985).(5,6) In most cases, during phase I therapy, the clinician recommends the patient use an antimicrobial agent for reducing plaque and gingivitis, as an adjunctive therapy (Nishihara, 2000; Addy, 2000; Ciancio, 2000). These microbial agents include metal salts (tin fluoride, zinc, or copper);( Stephen, 1987) essential oils;( Lusk, 1974) phenols (triclosan); (Jenkins, 1993) fluorides (sodium fluoride or stannous fluoride); (Beiswanger, 1995) bisbiguanides (chlorhexidine); (Addy, 1986) quaternary ammonium compounds (chloride cetylpyridium); (Wolff *et al*., 1989) sanguinarine; (Wennstro¨m, 1985) and oxygenating agents (Jones, 1990) among others (Ciancio, 1995; Jackson, 1997). Clinical studies have shown that many of these antimicrobial agents have inhibitory effects on plaque and gingivitis compared to negative controls or placebos, in the absence of toothbrushing (Ciancio, 2000; Jackson, 1997) However, when using these microbial agents in combination with toothbrushing, they do not all provide a significant effect compared to a negative control in reduction of plaque and gingivitis (Addy, 2005) Chlorhexidine is considered the gold standard agent for its clinical efficacy in chemical plaque control (Addy, 2005; Segreto, 1986; Jones, 1997; Ellingsen, 1982) .

Chlorhexidine has broad antibacterial activity, with very low toxicity and strong affinity for epithelial tissue and mucous membranes (Jones, 1997) Besides its antiplaque effect, chlorhexidine is substantive, thus reducing levels of microorganisms in saliva up to 90% for severalhours (Addy, 2005; Jones, 1997; Arweiler *et al*., 2006). The use of chlorhexidine is burdened by some side effects that could affect patient compliance (Ciancio, 2000) The most notable of these is the staining it produces (Santos, 2003; Eriksen *et al*., 1985) Other side effects associated with chlorhexidine include the alteration in taste and mucosal erosions, (Arweiler *et al*., 2006; Bernardi *et al*., 2004) but these are less common. Studies have shown different methods to eradicate or minimize staining on enamel and cementum.(26,30,31) These results show the effectiveness of a 0.2% chlorhexidine with antidiscoloration system (ADS)mouthwash compared to a 0.2% chlorhexidine mouthwash. The ADS system is composed of ascorbic acid and sodium metabilsulfate. This clinical study aimed to assess the degree of staining and clinical efficacy of a 0.2% chlorhexidine mouthwash with ADS compared to a 0.2% chlorhexidine mouthwash in patients with chronic Periodontitis over a 15-day period. Other objectives of this clinical investigation were to determine patient compliance patterns assigned by the clinician, and the possible occurrence of other side effects, besides staining, after use of the mouthwash.

## MATERIALS AND METHODS

**Study Population:** A total of 17 patients (eight male and nine female, aged 35 to 69 years; mean age: 55.47 years) were initially included in the study. The mean number of teeth was 23.4 (third molars were excluded). Two patients were excluded because they did not follow thestudy protocol. The study was conducted at the Department of Periodontics Govt Dental College Srinagar.Allpatients signed written informed consent.

**Study Design:** This is a comparative, crossover, double-masked study between amouthwash that contains 0.2% chlorhexidine and a mouthwash containing 0.2% chlorhexidine with ADS. Patients were comprised of non-smokers with chronic periodontitis, ≥20 teeth, and without systemic diseases; such as uncontrolled diabetes, cardiovascular disease, and infectious diseases. Patients who were pregnant, nursing, or using antibiotics or anti-inflammatory drugs were also excluded. Chronic Periodontitis is defined as a plaque-induced periodontal infection ongoing with gingival inflammation, bleeding on probing from the gingival pocket area, reduced resistance of the periodontal tissues to probing (periodontal pocketing), clinical attachment loss, and alveolar bone loss. (Armitage, 1999) Each patient had a 15-day cycle using an undiluted 10-ml dose of a first mouthwash for 1 minute, twice daily (morning and evening).

The mouthwash samples for study were previously labeled, assigning the letters A (0.2% chlorhexidine mouthwash plus ADS) and B (0.2% chlorhexidine mouthwash). The delivery of each mouthwash to patients was done randomly with the help of a dental assistant masked to the researchers. Before each mouthwash cycle, patients were instructed not to drink coffee, wine, or tea 1 hour before or after using the mouthwash; a full supragingival prophylaxis was performed; and intraoral photographs were taken. At 7 and 15 days the plaque index (PI), (Silness, 1964; Lo¨e, 1967) gingival index (GI), (Loe, 1963; Loe, 1967) and Brecx staining index (BI)Lobene Stain index (LSI) (Gadhia *et al*., 2006; Lobene, 1968) were recorded. The three indexes were evaluated on all the teeth in the patient's mouth, excluding third molars. The GI and PI were evaluated in the four gingival units of the same teeth (mesial, distal, buccal, and palatal/lingual), and Lobene Stain index. scored by using the four-point scale: 0 - no stain detected, only tooth colour; 1 - stain covering up to one-third of the tooth surface; 2 - stain covering between one third and two-thirds of the tooth surface; 3- stain covering more than two-thirds of the tooth.The second criterion of Lobene Stain Index – the in- tensity of stain - was observationally scored by using the four-point scale: 0 - no stain; 1 - light stain; 2- moderate stain; 3- heavy stain. All patients remained 15 days without using any rinse (washout period). Then they performed the second 15-day cycle with a second mouthwash, after which the same clinical parameters were assessed at the end of this second cycle. The brushing technique used during the study corresponded to the modified Bass technique (36) along with interdental brushing. Toothpaste without sodium lauryl sulfate and with 0.05% fluoride to prevent interaction with chlorhexidine, a regular toothbrush, interdental toothbrush, and dental floss were given to each patient at the beginning of study. The questionnaire completed by the clinician (CS) at 7 and 15 days when using mouthwashes A and B took into account the PI, SI, LSI, and general data (name, age, sex, race, and so forth). In addition, the survey included questions related to the side effects (taste modification or injury to oral mucosa) of the mouthwash in the mouth experienced by patients during the study. After each cycle patients brought a filled questionnaire showing their compliance and the two empty mouthwash bottles. A single masked researcher(CS) performed clinical assessments and data collection. The data collection period was approximately1.5 months per patient.

**Data Analysis:** The results were evaluated with factorial analysis of variance. The primary outcome variable was patient pigmentation. Other variables tested were plaque reduction, gingival inflammation, and other side effects (food taste, mucosal irritation, and so forth). All the variables were tested between the two different mouthwashes within the same patient and over time, between weeks 1 and 2. Also considered was the interaction between treatment and time, exploring potential differences in the effect of the mouthwashes at Days 7 and 15. The interaction between the mouthwashes tested and patients was also considered, but if it was insignificant it was deleted from the model.

## RESULTS

Two patients were excluded because they did not correctly follow the sequence of use of the mouthwashes. A total of 15 patients (eight male and seven female) completed the study. All patients were treated with a fullsupragingival prophylaxis before each mouthwash cycle and were reevaluated at days 7 and 15 when using each mouthwash. No patients reported any complication or unexpected complaints. Figure 1 shows PI(32) over time, either at 7 or 15 days (P = 0.6161). The means and standard deviations of the PI for mouthwash A (0.2% chlorhexidine plus ADS) at 7 and 15 days were 0.077±0.085 and 0.087 ±0.129, respectively. For mouthwash B (0.2% chlorhexidine) the means and standard deviations of the PI at 7 and 15 days were 0.135 ± 0.278 and 0.175 ±0.267, respectively. The two mouthwashes (test and control group) were equally effective in reducing plaque in the patient. No statistically significant differences were observed in plaque

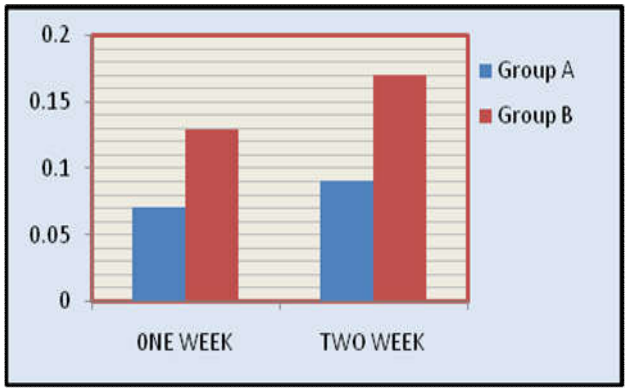


**Figure 1. Mean PI in test group (0.2% chlorhexidine with ADS) (A) and control group (0.2% chlorhexidine) (B) at 7 and 15 days. Confidence interval ≥95%; P = 0.1243**

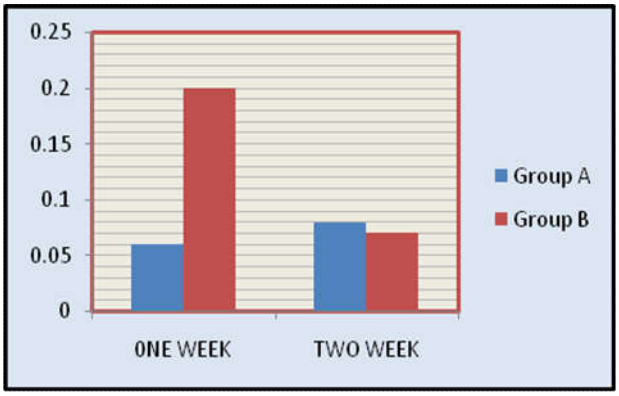


**Figure 2. Mean GI in the test group (0.2% chlorhexidine with ADS) (A) and the control group (0.2% chlorhexidine mouthwash) (B) at 7 and 15 days. Confidence interval ≥95%; P = 0.1688**

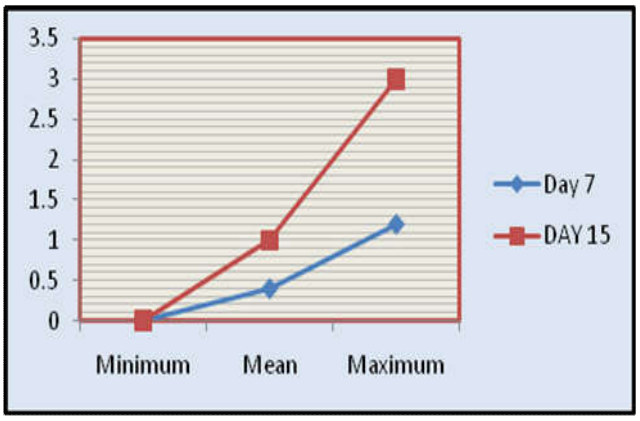


**Figure 3. LSI at 7 and 15 days after the use of both mouthwashes. Confidence interval≥95%. SD at 7 and 15 days: 0.323 ± 0.299 and 0.737 ±0.465, respectively**

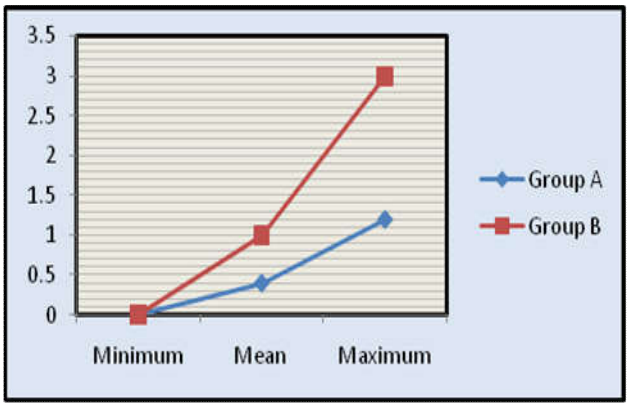


**Figure 4. LSI after using both mouthwashes: 0.2% chlorhexidine mouthwash with ADS (A) and a 0.2% chlorhexidine mouthwash (B). Confidence interval ≥95%; P ≤0.05. SD for A and B: 0.363 ± 0.314 and 0.697 ± 0.488, respectively**

reduction (P = 0.1243) between the two mouthwashes. Regarding the GI, (Loe, 1963) no statistically significant difference (P = 0.2253) was found in the GI over time, either at 7 or 15 days. The two mouthwashes presented a similar effectiveness on gingival inflammation, with no statistically significant difference (P = 0.1688). The means and standard deviations of the GI for mouthwash A (0.2% chlorhexidine plus ADS) at 7 and 15 days were 0.061 ±0.069 and 0.082 ± 0.085, respectively. The means and standard deviations of the GI for mouthwash B (0.2% chlorhexidine) at 7 and 15 days were 0.210 ± 0.363 and 0.072 ± 0.072, respectively (Fig. 2). Figure 3 shows that the more days the patients use each mouthwash, the greater the staining. With mouthwash B, LBS(35) is much higher than with mouthwash A (Fig. 4). The values obtained are statistically significant (P ≤0.05). The means and standard deviations of the LBS for mouthwash A (0.2% chlorhexidine plus ADS) at 7 and 15 days were 0.205 ± 0.194 and 0.521 ± 0.337, respectively. The means and standard deviations of the BI for mouthwash B (0.2% chlorhexidine) at 7 and 15 days were 0.441 ± 0.344 and 0.953± 0.484, respectively (Figs. 4 and 5). As for any other side effects reported after the use of the mouthwashes, the results suggest no significant difference between the two groups (P = 1.0000).

## DISCUSSION

After analyzing the results obtained during our clinicalstudy comparing 0.2% chlorhexidine mouthwashcontaining ADS to the standard 0.2% chlorhexidine,we observed that the mouthwash plus ADS has the same antiplaque and antigingivitis effects as the‘‘classic’’mouth wash with 0.2% chlorhexidine. Furthermore, a marked decrease in staining was observedwith the test mouthwash. In terms of other adverseeffects, we found two patients reporting bad tastethat may have resulted from the use of these mouthwashes (mucosal injury, burning mouth, or badtaste when eating), confirming previous studies (Moran, 1994; Santos, 2003; Ciancio, 2000; Armitage, 1999). Few studies have analyzed the staining produced after application of a mouthwash with ADS (Moran, 1994; Santos, 2003; Armitage, 1999; Lobene, 1968). In a study by Bernardi *et al*., (2004) 15 patients with oral health without gingivitis were given 0.2% ADS chlorhexidine mouthwash compared to a 0.2% chlorhexidine mouthwash for 15 consecutive days, with a 15-day intervening washout period between them. The authors evaluated the PI (Silness, 1964) and GI,( Loe, 1963) and assessed staining with a color measurement system‡ (based on the visible light spectrophotometer principle). Bernardi *et al*. (2004) concluded that there was no significant difference in relation to PI and GI between the two mouthwashes in healthy patients, but a statistically significant difference was observed in the adverse effect of staining, demonstrating that the mouthwash with ADS prevented pigmentations. The authors (Bernardi *et al*., 2004) recommended the need to conduct this study in patients with Periodontitis or with recessions. Our study, performed in patients with Periodontitis and recessions, corroborates the findings of Bernardi *et al*. (2004) Another paper by Basso *et al*., with a similar study design to Bernardi *et al*. (2004) confirmed both their results and ours, showing less staining

with a 0.2% chlorhexidine with ADS (unpublished data, 2006). Bellia′ *et al*. compared the 0.2% chlorhexidine mouthwash with ADS and 0.2% chlorhexidine toothpaste with ADS to the classic 0.2% chlorhexidine mouthwash and the 0.2% chlorhexidine toothpaste with ADS in 20 orthodontic patients who followed a nonsurgical periodontal therapy (unpublished data, 2006). This double-masked study showed that better results were achieved clinically and statistically in the control of plaque, gingival status, and staining in patients using the mouthwash with ADS (unpublished data, 2006). In contrast, the in vitro research conducted by Addy *et al*. (2005) claimed that they did not find statistically significant differences in terms of decreased staining with the ADS system incorporated in the 0.12% and the 0.2% chlorhexidine mouthwashes versus 0.2% chlorhexidine§ (positive control) and water (negative control). In addition, Arweiler *et al*. (2006) compared a 0.2%chlorhexidine mouthwash without alcohol to ADS versus 0.2% chlorhexidine mouthwash with 7% ethanoli to a placebo solution containing sorbitol, concentrated pepper, and alcohol at 14%, in 21 patients. They concluded that besides reducing staining, the ADS system also decreased the effectiveness of chlorhexidine on dental plaque, which contradicts the results of our study and those of others,(22,26,27,30,35) which found that chlorhexidine is effective in decreasing dental plaque. This article (Arweiler, 2006) assesses the effectiveness through bacteria that survived at 24 and 96 hours after using the mouthwash two times a day.

The most recently published study (Cortellini *et al*., 2008) using 0.2% chlorhexidine with ADS system compared it with a 0.2% chlorhexidine mouthwash for 1 week after periodontal surgery in 48 consecutive patients in treatment. The authors did not allow dental or interdental brushing over the area that underwent surgery. One week later, at suture removal, a full professional prophylaxis was performed and the second mouthwash was given with the same indications of use as the first mouthwash. The results were consistent with those obtained in our study: less staining was observed when using the 0.2% chlorhexidine mouthwash with ADS and similar effectiveness between the two mouthwashes in reducing gingival inflammation after surgery. The authors (Cortellini *et al*., 2008) stressed that after the use of the 0.2% chlorhexidine with ADS there were fewer adverse effects and a more pleasant taste sensation compared to the ‘‘classic’’ mouthwash (0.2% chlorhexidine). In our study, we also observed less staining with the 0.2% chlorhexidine with ADS, but we did not observe any other differences in side effects between the two mouthwashes. The compliance factor has not been mentioned in previous comparative clinical studies reviewed. It is important to note that according to our questionnaire, 88% of patients followed the instructions outlined in the protocol. Some limitations have to be taken into account in our study. The sample is small, and the evaluationof the staining used is subjective. Other more objectivemethods, such as spectrophotometry, to measurestaining are available, and the results might havebeen different.

### Conclusion

The ADS mouthwash produces less dental staining in patients with chronic periodontitis, and it is equally effective as an antiplaque and antigingivitis agent compared to 0.2% chlorhexidine mouthwash during a 15-day period of use. According to the questionnaire, 88% of patients followed the guidelines assigned by the clinician. The clinical manifestations and other possible adverse effects were minimal when using either mouthwash for a 15-day period. More controlled, randomized clinical studies with a larger sample size are needed.

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