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## Original Article

# Effect of Aloe vera, chlorine dioxide, and chlorhexidine mouth rinses on plaque and gingivitis: A randomized controlled trial



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## ABSTRACT

**Objective:** To evaluate the effect of Aloe vera, chlorine dioxide, and chlorhexidine mouth rinses on plaque and gingivitis in orthodontic treatment.

**Materials and methods:** A randomized single-center, single-blind, parallel group, controlled trial was conducted among 90 subjects undergoing fixed orthodontic treatment. The subjects were randomly divided into one of the three study groups (Aloe vera, chlorhexidine, chlorine dioxide). Plaque and gingivitis were assessed using modified Silness and Loe Plaque Index and Gingival Index at baseline and at follow-up after 15 days. Paired t-test and ANOVA with post hoc Dunnett test were used. A *p*-value of <0.05 was considered statistically significant.

**Results:** A total of 85 participants completed the study; among them, 40 were male and 45 were female. There was significant reduction in mean plaque and gingival scores in all the 3 groups at follow-up when compared to baseline. A significantly higher reduction (plaque and gingival scores) was found in chlorhexidine when compared with the Aloe vera group. However, no significant difference was seen between chlorhexidine and chlorine dioxide with respect to mean reduction in plaque and gingival scores.

**Conclusion:** Chlorine dioxide can be a suitable and economical alternative for chlorhexidine. Further long-term studies are recommended for evaluating their effectiveness.

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## 1. Introduction

Periodontal diseases (gingivitis and periodontitis) and dental caries are the two most prevalent oral diseases for which

plaque is the common etiological factor.<sup>1</sup> Plaque control is the basis and goal for prevention of gingivitis, periodontitis, and dental caries and mechanical plaque control is the most dependable way of achieving oral health benefits. However, complete plaque removal is difficult to achieve and prevention

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can be achieved by reducing the quantity of plaque below the threshold level for disease or by changing the quality of plaque toward more protective composition.<sup>2</sup>

It is known that adequate plaque control is difficult in patients undergoing orthodontic treatment, especially in the cases of children and adolescents. According to Lundstrom and Hampton,<sup>3</sup> it is particularly difficult to maintain an acceptable oral hygiene when bands, wires, and ligatures are involved. Fixed orthodontic appliances in oral cavity lead to favorable conditions for the development of dental plaque and eventually increasing the bacterial load. Zachrisson and Zachrisson reported the development of hyperplastic gingivitis within 1–2 months after placement of appliances.<sup>4</sup> A thorough home care plaque control program (both mechanical and chemical) would reverse the inflammatory changes in the gingival tissues.<sup>5</sup>

A wide array of products for mechanical (tooth brushing and flossing) and chemical plaque control measures is commercially available. Antimicrobial mouth rinses are one such product that is recommended to be an adjunct to mechanical plaque control.<sup>6–8</sup> The clinical effectiveness of the mouthrinses that contain active agents, such as chlorhexidine, triclosan, and cetylpyridinium chloride have been well documented.<sup>9–11</sup> Adverse effects like disturbance in taste sensation, tooth staining, and desquamation or soreness of oral mucosa over long-term usage were also well documented.<sup>12,13</sup> Triclosan has been suspected to cause resistant strains of bacteria and allergic contact dermatitis<sup>14</sup> while cetylpyridinium chloride mouthrinse has been found to cause tooth staining and burning sensation.<sup>15</sup> Hence, there is an increasing demand to explore for alternative agents, which have minimal or no adverse effects over extended usage.<sup>16</sup> Among many other agents developed, Aloe vera and chlorine dioxide showed promising results.

Aloe vera is a medicinal plant with mucilaginous tissue in the center of the leaf. It has been traditionally used for treatment of digestive tract disorders, sunburn, and wounds. The active compounds include aloesin, aloin, aloeride, naftoquinones, methylchromones, flavonoids, saponin, sterols, etc. Various in vitro and in vivo studies reported the pharmacological actions of Aloe vera gel, viz., anti-inflammatory, antibacterial, antiulcer, and antioxidant.<sup>17–20</sup> Considering the beneficial effects along with ease of availability, low cost, and no known adverse effects, Aloe vera could be a suitable alternative for prolonged use as plaque control agent.

Recently, a mouth rinse containing chlorine dioxide (ClO<sub>2</sub>) has become commercially available in the market (Freshclor, Group Pharmaceuticals Ltd, Bangalore, India). Its active ingredient is sodium chlorite as stabilized chlorine dioxide. Oral rinses containing ClO<sub>2</sub> are now utilized in dental practices as a topical antiseptic for oral cavity and dentures.<sup>21,22</sup> Previous studies have suggested that ClO<sub>2</sub> and chlorite anion are powerful bactericidal agents to most of the periodontogenic microorganisms.<sup>23–25</sup> It was also shown to be effective in treating halitosis, plaque, and gingivitis.<sup>26,27</sup>

Owing to minimal adverse effects of these newer materials when compared to clinical gold standard (chlorhexidine), it is worthwhile to evaluate the effectiveness of these agents among patients undergoing fixed orthodontic treatment. Hence, we aimed to conduct a randomized controlled trial

to evaluate the effect of Aloe vera, chlorine dioxide, and chlorhexidine mouth rinses on plaque and gingivitis in orthodontic patients.

## 2. Materials and methods

A randomized single-center, single-blind, parallel group, controlled trial was conducted among subjects undergoing orthodontic treatment. The study was registered with Clinical Trial Registry of India (CTRI/2014/08/004844). Ethical approval to conduct the study was obtained from the Ethics Committee, Kasturba Medical College, Manipal. Subjects aged more than 18 years of age, with visible plaque and gingivitis in at least 30% of the teeth examined and those who were undergoing fixed orthodontic treatment for more than 3 months, were recruited from Department of Orthodontics, Manipal College of Dental Sciences, Manipal University, Manipal. Subjects with multiple restorations and gross dental caries, any form of topical or systemic antibiotic treatment during the past 2 weeks, current users of tobacco in any form, current users of any other mouth rinse, antimicrobials, or any medications, and subjects with functional or removable appliances were excluded.

All the participants were screened for inclusion and exclusion criteria, and 90 eligible participants were included. Participants were explained about the study and informed consent was obtained. Clinical examination to assess plaque accumulation and gingivitis was done by a single trained and calibrated examiner (YSK). Plaque and gingivitis were assessed using modified Silness and Loe Plaque Index (William et al., 1991) and Gingival Index (Loe and Silness, 1963) at baseline and at follow-up after 15 days (Fig. 1).

Allocation concealment was done by the investigator (PKC) who was not involved in clinical examination and was revealed after the completion of the study. Eligible subjects were called for picking one number from the bowl which was numbered as per the allocation concealment. This procedure ensured that the subjects were randomly divided into one of the three study groups (Aloe vera, chlorhexidine, chlorine

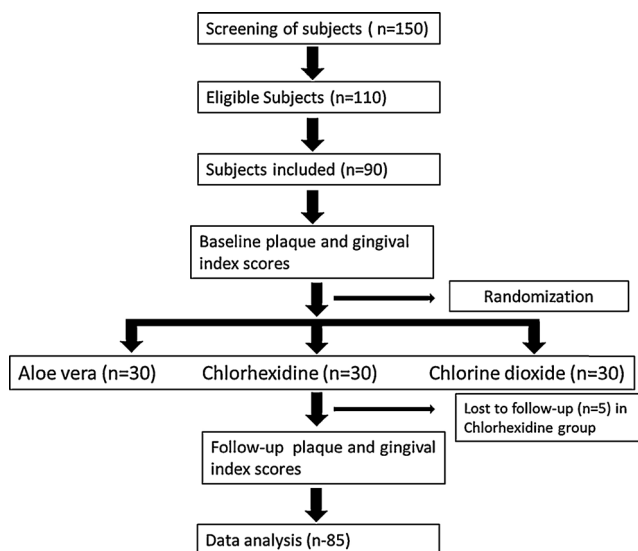


Fig. 1 – Experimental flow diagram of study.

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