

Chemical Plaque Removal Efficacy in Subjects with Fixed Orthodontic Appliances: A Comparative Study

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ABSTRACT

Introduction: Orthodontics has become a vital part of dentistry. Maintaining oral hygiene is very critical, particularly prior to and during orthodontic treatment. Almost all patients with fixed orthodontic appliance will get gingivitis at some point during the treatment. So, the present study was conducted to evaluate the plaque removal efficacy of different mouthwashes in subjects with fixed orthodontic appliances.

Materials and methods: A total of 45 subjects were involved in this study. And these were randomly allotted three groups, i.e., group I: Neem mouthwash, group II: Aloe vera mouthwash, and group III: Chlorhexidine mouthwash. Clinical examination was done using plaque index (PI) and gingival index (GI) at baseline and after 1 month. Data were summarized using Statistical Package for the Social Sciences (SPSS) software version 20. Paired t-test was used to analyze the statistical significance.

Results: Among all the three different mouthwash groups, group III (chlorhexidine mouthwash) showed a maximum plaque reduction after 1 month (0.312 ± 0.112), followed by group I (neem mouthwash) 0.516 ± 0.202 , group II (aloe vera mouthwash) 0.844 ± 0.012 . Significant difference was found in the reduction of plaque scores among all the three groups. In GI score, group III (chlorhexidine mouthwash) showed a maximum reduction after 1 month. (0.290 ± 0.028), followed by group I (neem mouthwash) 0.320 ± 0.022 , group II (aloe vera mouthwash) 0.680 ± 0.028 . Significant difference was found in chlorhexidine mouthwash and neem mouthwash groups.

Conclusion: The present study concluded that both neem and aloe vera mouthwashes can be used as an alternative to chlorhexidine mouthwash, as they reduced PI score significantly and it could be helpful to orthodontic subjects in maintaining their oral hygiene.

Keywords: Dental plaque, Fixed orthodontic appliances, Gingivitis, Mouthwash.

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INTRODUCTION

Periodontal disease is one of the diseases that influence the supporting tissues of the teeth. Gingivitis, which is initial stage of periodontal disease, is generally caused due to insufficient oral hygiene. Gingivitis is characterized by inflammation, redness, and bleeding on probing. Plaque forms on the surface of teeth and gingiva is the chief causative factor for gingivitis.¹

Orthodontics has become a vital part of dentistry. Maintaining oral hygiene is very critical, particularly prior to and during orthodontic treatment. Almost all fixed orthodontic treatment patients land up getting gingivitis during the treatment.²

Nevertheless, in fixed orthodontic appliances, bands, brackets, buccal tubes, cleats, ligature wires, coil springs, arch wires, and elastics are placed on the tooth surface; this makes removing of food particles and oral hygiene maintenance difficult. The orthodontic appliance on the tooth surface provides further retentive area for the deposition dental plaque. Hence, sufficient plaque removal only through mechanical methods may be tricky in patients undergoing orthodontic treatment.³

Chemical plaque control should be added in conjunction with mechanical methods. The chemical plaque control consists of organic or inorganic chemicals, which restrain the build-up, growth, and survival of microbiota and dental plaque. The added advantage of chemical plaque control is increased concentration of microbial agent in gingival crevicular fluid and saliva which controls microbial growth and improves gingival health.⁴

Lately, many microbial agents have been advocated which are either available in a toothpaste/dentifrices or in the form of a mouthwash. Out of them, chlorhexidine is regarded as gold standard in dentistry for the prevention of dental plaque. A variety of mouthrinses that are available nowadays have certain side effects and are also expensive. Chlorhexidine mouthwash, though very effective, also has certain side effects like oral mucosal erosion,

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brown discoloration of the teeth, and bitter taste.⁵ Hence, there is a necessity for an alternative medicine that is safe and economical. Hence, the present study was conducted to evaluate the plaque removal efficacy of different mouthwashes in subjects with fixed orthodontic appliances.

MATERIALS AND METHODS

The present comparative study includes the study subjects with the age of 18 to 35 years, who were started newly with fixed orthodontic treatment in the Department of Orthodontics. A total of 45 subjects were involved in this study. Informed consent was taken from all the participating subjects. The inclusion criteria for the present study were subjects with no antibiotic or antibacterial mouthwash usage within the last 1 month, no systemic disease, with complete dentition up to the second molar, and no caries or demineralization. Subjects on oral antimicrobials or antibiotic within the past 3 months and subjects with prosthodontic appliances were excluded from the study.

All 45 subjects were randomly allotted into three groups as follows:

- Group I: Neem mouthwash (15 subjects)
- Group II: Aloe vera mouthwash (15 subjects)
- Group III: Chlorhexidine mouthwash (15 subjects)

Subjects were explained to use 5 mL, 2 times a day, and all the clinical examination was done at baseline and after 1 month, after starting of orthodontic treatment.

Toothpaste and orthodontic toothbrushes (Oral B) were distributed to all subjects after bonding. The horizontal scrub method was shown to clean their teeth for 2 minutes for at least twice a day. The subjects were instructed to avoid any food or drink during 1 hour after using the mouthwashes.

Clinical Examination

Gingival Index

A periodontal probe (Williams) was inserted at an angle of 45° into the gingival sulcus and with minimal pressure, running the probe from interproximal to interproximal along the buccal and lingual sides of all teeth. If it bleeds within 10 seconds after probing, the site is positive.

Plaque Index

It was recorded by placing a periodontal probe in between the bracket base and free gingival margin at six sites around every tooth; if any plaque deposits were found, the site was positive.

Statistical Analysis

Data obtained were entered in Microsoft excel and summarized using SPSS software version 20. Mean and

standard deviation (SD) were calculated. Paired t-test was used to analyze the statistical significance.

RESULTS

Overall, 45 subjects (22 males and 23 females) were involved in this study. Table 1 shows the mean and SD of PI scores. Reduction of plaque scores was found more in group III (0.312 ± 0.112) followed by group I (0.516 ± 0.202), group II (0.844 ± 0.012).

Table 2 shows the mean and SD of GI scores. Reduction of GI scores was found more in group III (0.290 ± 0.028) followed by group I (0.320 ± 0.022) and group II (0.680 ± 0.080).

Table 3 shows mean plaque scores comparison between groups at baseline and after 1 month. Among all the three different mouthwash groups, group III (chlorhexidine mouthwash) showed a maximum plaque reduction after 1 month (0.312 ± 0.112), followed by group I (neem mouthwash) 0.516 ± 0.202 and group II (Aloe vera mouthwash) 0.844 ± 0.012 . And significant difference was found in the reduction of plaque scores among all the three groups.

Table 4 shows the mean gingival scores comparison between groups at baseline and after 1 month. Among all the three different mouthwash groups, group III (chlorhexidine mouthwash) showed a maximum reduction of GI scores after 1 month. (0.290 ± 0.028), followed by group I (neem mouthwash) 0.320 ± 0.022 , group II (aloe vera mouthwash) 0.680 ± 0.028 . And significant difference was found in chlorhexidine mouthwash and neem mouthwash groups.

Table 1: Mean and SD of PI scores

| Groups | n | Baseline | After 1 month |
|--------|----|---------------|---------------|
| I | 15 | 1.124 ± 0.142 | 0.516 ± 0.202 |
| II | 15 | 1.268 ± 0.014 | 0.844 ± 0.012 |
| III | 15 | 1.101 ± 0.216 | 0.312 ± 0.112 |

Table 2: Mean and SD of GI scores

| Groups | n | Baseline | After 1 month |
|--------|----|---------------|---------------|
| I | 15 | 0.812 ± 0.046 | 0.320 ± 0.022 |
| II | 15 | 0.872 ± 0.130 | 0.680 ± 0.080 |
| III | 15 | 0.742 ± 0.102 | 0.290 ± 0.028 |

Table 3: Comparison of mean PI scores between groups at baseline and after 1 month

| Groups | | Mean ± SD | t-value | Significance |
|--------|---------------|---------------|---------|--------------|
| I | Baseline | 1.124 ± 0.142 | 8.24 | 0.001 |
| | After 1 month | 0.516 ± 0.202 | | |
| II | Baseline | 1.268 ± 0.014 | 7.62 | 0.04 |
| | After 1 month | 0.844 ± 0.012 | | |
| III | Baseline | 1.101 ± 0.216 | 6.14 | 0.001 |
| | After 1 month | 0.312 ± 0.112 | | |

Table 4: Comparison of mean GI scores between groups at baseline and after 1 month

| Groups | | Mean \pm SD | t-value | Significance |
|--------|---------------|-------------------|---------|--------------|
| I | Baseline | 0.812 \pm 0.046 | 9.44 | 0.001 |
| | After 1 month | 0.320 \pm 0.022 | | |
| II | Baseline | 0.872 \pm 0.130 | 9.16 | 0.06 |
| | After 1 month | 0.680 \pm 0.080 | | |
| III | Baseline | 0.742 \pm 0.102 | 8.06 | 0.001 |
| | After 1 month | 0.290 \pm 0.028 | | |

DISCUSSION

Development of bacterial biofilm around the marginal gingiva and within the periodontal pocket is crucial in the pathogenesis of periodontal disease. Alteration of flora can be successfully achieved by scaling and root planing.⁶ Oxidative stress plays a vital part in the periodontal disease pathogenesis, along with various different conditions. It is well known that inflammatory diseases can be defended by antioxidants.⁷ Also, the occurrence of fixed appliances upon surfaces of teeth, such as bands and brackets makes cleaning of teeth more difficult and leads to the accumulation of plaque.

In the present study, neem mouthwash shows a statistically significant reduction of PI and GI scores. For reducing periodontal problems Chlorhexidine is considered as the gold standard but in the present study, neem mouthwash was almost equally effective. The present study results are in agreement with the study done by Botelho et al⁸ who reported that Azadirachta indica-based mouthrinse was highly effective and that it could be used as an alternate therapy in periodontal disease treatment. Few studies have also reported that neem extract lessened the bacterial load and plaque levels. Patel and Venkatakrishna Bhatt⁹ found significantly decreased probing depth and improvement in clinical attachment level by use of neem extract.

In the present study, aloe vera mouthwash shows a statistically significant reduction of PI scores. The lesser plaque levels measured in the study participants could be due to the potent antibacterial nature of aloe vera. Hegggers et al¹⁰ studied its antimicrobial effects against various microorganisms like *Candida albicans*, *Streptococcus pyogenes*, *Streptococcus faecalis*. Aloe vera was used by Noskov¹¹ to treat periodontitis in early stages and recorded positive results. It was observed that chlorhexidine as well as aloe vera mouthwashes reduced plaque scores significantly. The present study results are also in agreement with the study by Karim et al,¹² where plaque scores were found to have reduced following the use of aloe vera mouthwash for periods of 30 and 22 days.

Even though mechanical plaque control is a very efficient way of preventing the periodontal disease progression, adhering to the appropriate brushing habits and

use of dental floss on a daily basis by most individuals are infrequent. The daily use of an efficacious mouthrinse daily is a simple way by which majority of the patients can effortlessly make this a part of their routine oral hygiene practice.¹³

Although discovered in the 1950s, chlorhexidine is still found to be one of the most effective antiplaque agents. But, its long-term use is limited due to its unpleasant taste and its disadvantages like brownish staining of the teeth.¹⁴

According to Ainamo,¹⁵ use of chlorhexidine could provide motivation for patients, by making them become aware of the sensation of cleanliness and thereby develop mechanical ability for plaque control. Numerous chemical mouthwashes are present in the market, but they have many side effects like toxicity, immediate hypersensitivity reactions, tooth staining, etc. Alternative therapeutics derived from medicinal plants can serve as successful alternatives in place of synthetic drugs and prevent potential side effects.

Existence of brackets and arch wires obstructs the normal cleansing of plaque and food debris. Therefore, dentists suggest use of mouthrinse for longer durations to prevent plaque accumulation, gingivitis, and poor oral hygiene that are found routinely in subjects undergoing orthodontic treatment.

CONCLUSION

The present study concluded that both neem and aloe vera mouthwashes can be used as an alternative to chlorhexidine mouthwash, as they reduced PI score significantly and it could be helpful to orthodontic subjects in maintaining their oral hygiene.

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