



BRUSHING UP ON ORAL HYGIENE: THE ROLE OF MOUTHWASHES IN ORTHODONTIC CARE

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Abstract: The aim of this article is to provide an explanation of the importance of oral hygiene for patients with fixed orthodontic appliances and the different mouthrinses available for maintaining oral hygiene in patients with fixed orthodontic appliances.

Materials and Methods: To gather information, an extensive search was performed utilizing electronic databases such as PubMed, Google Scholar, and several other orthodontic journals. The search focused on articles published with the studies that examined the significance of oral health in patients with fixed orthodontic appliances and the effectiveness of various mouth rinses in sustaining oral health in fixed orthodontic patients, and other malocclusions were included for review.

In conclusion, prioritizing oral health during orthodontic treatment is crucial, and while chlorhexidine remains a reliable option, herbal mouthwashes present a promising alternative with fewer potential side effects. By combining mechanical and chemical methods, orthodontic patients can achieve the best possible results for their oral health.

I. INTRODUCTION

Orthodontic treatment helps in achieving periodontal health by correcting malocclusion, though it increases the number of sites for retention of plaque and hinders with mechanical plaque controlling methods, leading to its accumulation, gingivitis, and periodontal disease. (1) Periodontal disease and dental caries arise from multiple factors, with the accumulation of dental biofilm being one of the most significant contributors. The placement of orthodontic appliances represents the most critical environmental shift following tooth eruption, potentially leading to qualitative and quantitative alterations in the balance of oral microbiota, thereby facilitating an increase in microorganisms present in both saliva and bacterial plaque.(2) (3)

During orthodontic care, orthodontists should implement strategies to manage and prevent oral biofilm by encouraging patients for adopting new habits—in addition to addressing malocclusion and improving esthetics. Biofilm control can be achieved through mechanical or chemical approaches. Regular plaque control via mechanical methods, either through oral health practices or professional sessions, is widely regarded as the most effective preventive measure. Unfortunately, inadequate oral hygiene often results in the use of mouthwashes containing antimicrobial agents to reduce bacterial levels and prevent the recolonization of microbes.

While mechanical plaque control is a reliable method to halt the advancement of periodontal diseases, a significant number of individuals fail to brush teeth properly and neglect the use of dental floss. Using mouthwash regularly, is an efficient approach. However, fixed orthodontic patients, who struggle to manage biofilm through regular cleaning methods may need assistance in managing inflammation and improving oral health through the use of chemical treatments.

The chlorhexidine mouthwash has the ability to eliminate a wide range of microorganisms, providing a long-lasting and continuous antimicrobial effect.(4) The main advantage is the extensive antimicrobial spectrum, with prolonged and continuous effect. Thus, it is considered as a gold standard while conducting research for maintain oral hygiene. Nevertheless, the prolonged use of chlorhexidine may lead to side effects, such as extrinsic tooth staining and oral mucosal pigmentation. Consequently, a highly effective antimicrobial agent with minimal adverse effects would be to combat oral infections. One alternative to traditional mouthwash is the use of liquorice root extract mouthwash. The roots and stolons of glycyrrhiza species, known as liquorice, have been utilized for centuries as a traditional herbal remedy.

II. RESEARCH METHODOLOGY

The methodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample A systematic literature search was performed utilizing electronic databases including PubMed, Google Scholar, and relevant orthodontic journals. Keywords such as were “Fixed orthodontic patients” in conjunction with “Chlorhexidine mouthrinse”, “ mouthrinse,” “oral hygiene,” and “Orthodontic treatment,” were used to identify pertinent articles published within the last two decades. Studies focusing on the use of mouthwash for maintaining oral hygiene in fixed orthodontic patients were included for review. Ethical committee approval and patient consent were not applicable for the study, as this was a review of the literature.

III. RESULTS

3.1 Oral Hygiene in Orthodontic Patients

During orthodontic treatment, fixed braces significantly hinder tooth brushing, creating an ideal environment for plaque to quickly accumulate. The larger the surface area of the teeth covered by brackets and the more complex the components of the appliance, the more challenging it becomes for patients to effectively maintain hygiene. Consequently, enamel demineralization and gingivitis have been identified as the most common consequences of oral biofilm development among orthodontic patients, impacting 50% to 70% of patients with fixed appliances. (5)

In general, dental professionals give routine oral hygiene instructions to patients undergoing orthodontic treatment, but the impact of these instructions may be restricted. Consequently, patients' drive is of utmost importance and plays a crucial role in sustaining their preferred oral hygiene practices. So far, it is hoped that more and more research has concentrated on how orthodontic professionals can encourage their patients regarding oral health, with additional motivational strategies being implemented despite standard orthodontic practices. The treatment is designed to eliminate dental plaque and tartar, while also encouraging individuals should practice proper oral hygiene habits to manage the dental biofilm. This can be accomplished through mechanical, chemical, or other techniques.

A thorough literature review regarding oral hygiene among patients with fixed orthodontic appliances and the application of chlorhexidine and various mouthwashes in the preservation of oral cleanliness:

In a study conducted by Yeung in 1989, the gingival and periodontal health of 62 adolescent patients with fixed orthodontic appliances was assessed both before and after treatment in a controlled clinical environment. The results indicated a general improvement in gingival health among the study participants. Additionally, the oral hygiene program implemented in the experimental group resulted in significantly lower scores on the Bleeding Index(BI), Gingival Index(GI), Plaque Index(PI), Periodontal pocket depth measured when compared to the control group.(6)

In a study conducted by Gissela Bernal Anderson in 1997, the short-term clinical effects of rinsing with 0.12% chlorhexidine gluconate compared to a placebo were assessed in 30 adolescents (aged 11 to 15)

receiving orthodontic treatment. The findings suggested that the use of chlorhexidine, alongside standard oral hygiene practices, effectively decreased plaque and gingivitis in adolescents undergoing orthodontic care.(7)

In 1991, Brightman conducted a study evaluating the efficacy of a 0.12% chlorhexidine gluconate (CH) mouthrinse, known as Peridex, on 34 orthodontic patients aged between 11 and 17 years who had confirmed gingivitis. The use of Peridex, alongside mechanical plaque removal, was demonstrated to be a significant therapeutic agent in reducing Plaque index, Gingival Index, Bleeding Index, thus managing inflammation, bleeding and plaque accumulation, among orthodontic patients aged 11 to 17 years with established gingivitis.(8)

A 2006 study conducted by Salehi assessed the antimicrobial properties of persica mouthwash in comparison to chlorhexidine among patients undergoing fixed orthodontic treatment. The use of persica not only resulted in a notable decrease in streptococcus mutans colonies but also produced less tooth discoloration and had a more pleasant taste than chlorhexidine. This evidence may support the integration of herbal compounds as complementary options in the care of orthodontic patients.(9)

In a study conducted by Tufekci et al in 2008, the effectiveness of an Essential Oil Mouthrinse on improving oral health in patients undergoing orthodontic treatment was compared, and it was found that Listerine mouthrinse can decrease the levels of plaque and gingivitis in these patients. The findings of the investigation revealed that the application of Listerine mouthrinse led to a significant reduction in both plaque and gingivitis when compared to the control group. Individuals who included Listerine in their daily oral care routine demonstrated notably reduced scores for Bleeding Index, Gingival Index and Plaque Index, between an interval of 3-6 months, compared to those who solely brushed and flossed.(10)

In 2009, Dogan et al. assessed the absolute and relative antibacterial effectiveness of octenidine dihydrochloride (OCT) against total and cariogenic bacteria found in saliva samples from patients with fixed orthodontic appliances over a period of 5 days. Over this 5-day usage, OCT emerged as the most effective mouth rinse among those tested, demonstrated by a significant decrease in both total salivary and cariogenic bacterial counts.(11)

In a 2021 study conducted by Narinder Pahwa, the short-term clinical efficacy of a commercially available 0.07% cetylpyridinium chloride mouth rinse was evaluated in patients receiving fixed orthodontic treatment, comparing it with a placebo mouth rinse and a group using a toothbrush and toothpaste. The results indicated that the 0.07% cetylpyridinium mouth rinse was effective in decreasing the scores for bleeding and plaque index. However, it did not show efficacy in decreasing the modified gingival index scores. The control group and the toothbrush group did not demonstrate any significant improvements in the bleeding scores, modified gingival index, or plaque scores.(12)

In the research conducted by Bilbilova in 2015, the impact of chlorhexidine mouth rinse on plaque and gingival bleeding was assessed, focusing on its effectiveness in preventing demineralization among orthodontic patients with fixed appliances. The results of the plaque index and gingival inflammation assessments revealed statistically significant differences between the two groups across one-month and three-month time period. A statistically significant reduction in WSLs was observed in the chlorhexidine group, one month and three months following treatment. Consequently, incorporating a chlorhexidine mouth rinse into the daily oral care routine diminishes the development of plaque and gingivitis in patients undergoing orthodontic treatment.(13)

In a systematic review conducted by Kommuri in 2021, she evaluated the effectiveness of herbal mouthwashes compared to chlorhexidine mouthwashes for maintaining oral hygiene in patients receiving fixed orthodontic treatment. Among eight randomized controlled trials (RCTs), one trial showed a preference for chlorhexidine while another favored herbal mouthwashes. Three trials reported similar effects for the respective oral health maintenance-related parameters examined. In two studies, chlorhexidine exhibited superior antimicrobial activity against *Streptococcus mutans* (*S. mutans*), whereas one RCT indicated comparable antimicrobial effectiveness. Sub-group analyses for colony-forming units, gingival index and plaque index, prior to the use of chlorhexidine and herbal mouthwashes yielded

inconclusive results. However, she concluded the comparison between efficacy of herbal and chlorhexidine towards OHM in patients undergoing fixed OT remains debatable. (14)

In 2021, a study conducted by Faria et al. assessed the anti-inflammatory and antimicrobial properties of mouthwashes containing 0.12% chlorhexidine (CLX) and 0.5% Zingiber officinale essential oil (ZOEO). The microbiological evaluation indicated that the ZOEO mouthwash was effective against *Streptococcus mutans*, similar to the CLX mouthwash, although it did not exhibit the same level of substantivity. The ZOEO was effective in managing dental biofilm and decreasing gingival bleeding. (15)

In a 2022 study conducted by Deepa Kamath and colleagues, the effectiveness of aloe vera mouth rinse was assessed for its impact on dental plaque and gingivitis in patients receiving fixed orthodontic treatment, comparing it with a 0.2% chlorhexidine mouthwash. The gingival index indicated a statistically significant variation from baseline to the 21-day and 35-day assessments in both groups. The plaque index and bleeding on probing also showed statistically significant results in both groups when comparing the baseline to the 21-day and 35-day assessments, although no significant difference was observed between the second and third visits. While chlorhexidine remains the standard reference for mouth rinses, aloe vera demonstrates encouraging results in lowering plaque and gingivitis scores, with no adverse effects reported. Further extensive multi-centric studies are necessary to validate its effectiveness against dental plaque-induced gingivitis. (16)

In a 2021 review by Aristeidis, the effectiveness of essential oil (EO)-based mouthwashes for managing gingivitis in patients with fixed orthodontic treatment was investigated. The review included six clinical studies. Four of the studies demonstrated that Listerine® effectively controlled gingivitis in patients undergoing fixed orthodontic treatment. One study indicated that a mouthwash containing 5% *Fructus mume* led to a significant decrease in gingival bleeding. Additionally, mouthwashes with 1% *Matricaria chamomilla* L. and 0.5% *Zingiber officinale* were also found to be effective in reducing gingival bleeding. There were four studies with low risk of bias, one with moderate risk, and one with high risk. In summary, EO-based mouthwashes appear effective for managing gingivitis in patients receiving fixed orthodontic treatment, but further well-designed and adequately powered clinical trials are necessary. (17)

Ren et al (18) in their review determined that using fluoride mouthwashes for a short duration might decrease the number of cariogenic bacteria, although the long-term effects are unclear. Chlorhexidine has the potential to diminish the colony counts of various microorganisms in the short term. The brief use of Chlorhexidine and herbal mouthwashes may successfully lower indices related to plaque and gingival inflammation.

A comprehensive literature review on oral hygiene and the use of different mouthwashes:

In 2007, Albert-Kiszely A examined the effects of a test mouthwash containing 0.07% cetylpyridinium chloride (CPC) (Crest Pro-Health) compared to a commercially available mouth rinse with essential oils (EOs) (Listerine) on the accumulation of dental plaque and the prevention of gingivitis. The results of this research suggested that there was no significant statistical difference in the anti-plaque and anti-gingivitis effects between the CPC mouth rinse being tested and the positive control mouth rinse with EOs over a period of six months. (19)

In a 2013 study conducted by Balappanavar, he assessed and compared the efficacy of mouthwashes containing 0.5% tea, 2% neem, and 0.2% chlorhexidine on oral health. The 0.5% tea mouthwash demonstrated greater effectiveness than both the 2% neem and the 0.2% chlorhexidine rinses. During the three-week trial period, mean scores for plaque and gingivitis decreased in both the experimental and control groups. All groups exhibited anti-plaque properties, with the highest effectiveness observed in the group using 0.5% tea. Neem and tea exhibited comparable effectiveness on the gingiva, surpassing that of chlorhexidine. (20)

In 2015, Ardakani et al. examined the antibacterial effects of three different mouthwashes on supragingival plaque microbiota, both in vitro and in vivo. The three mouthwashes being studied were 0.2% chlorhexidine (CHX), Listerine®, and Persica (PM), with water used as the negative control. After two weeks of mouthwashing, all three commercial mouthwashes (0.2% CHX, Listerine®, and PM) proved to be more effective than water in lowering bacterial counts. While 0.2% CHX was marginally more effective

than Listerine®, the difference was not statistically significant. PM also contributed to a reduction in bacterial counts, but significantly less so than 0.2% CHX. These results align with those of Tomas et al.(21) who found a decrease in the bacterial count within the oral cavity following the use of CHX mouthwash.(22)

In 2018, Ramamurthy et al. published findings comparing the effects of Hiora mouthwash and Chlorhexidine mouthwash for managing gingivitis. The study concluded that there was no significant difference in the effectiveness of the two mouthwashes, and both proved to be effective in treating gingivitis.(23)

IV. DISCUSSION

Orthodontic treatment is crucial for enhancing dental alignment, but it also presents difficulties in ensuring proper oral hygiene. Orthodontic appliances, such as braces, can make it more challenging for patients to clean their teeth, leading to the buildup of plaque, gum inflammation, enamel erosion, and, in extreme cases, periodontal disease. This review emphasizes the importance of oral hygiene in orthodontic patients, specifically addressing the role of mouthwashes in assisting with plaque control and minimizing inflammation during orthodontic treatment.

In orthodontic treatment, maintaining proper plaque control is of utmost importance to avoid complications like gingivitis and enamel demineralization, which are more common in patients with fixed appliances. Mechanical methods of oral hygiene, like brushing and flossing, are the initial line of defense against dental issues, but they may not be enough due to the challenge of reaching areas around the braces. Consequently, chemical agents, such as mouthwashes, become crucial additions to aid in controlling bacterial growth and alleviating gingival inflammation.(6)(7) Chlorhexidine, a commonly employed antimicrobial mouthwash, is recognized for its broad-spectrum activity and its capability to significantly decrease plaque and gingivitis.(1)

Nevertheless, the prolonged use of chlorhexidine has been linked to certain side effects, such as tooth discoloration and changes in the pigmentation of the oral mucosa.(4) These negative consequences emphasize the necessity for alternative mouthwashes that have fewer side effects. Numerous studies have investigated the use of herbal mouthwashes as possible alternatives to chlorhexidine. For example, liquorice root extract has demonstrated potential because of its antimicrobial effects and low risk of side effects.(24) Other herbal mouthwash formulations, like those that include Aloe Vera, Neem, and essential oil from Zingiber officinale, have also shown effectiveness in decreasing plaque and gum inflammation.(16)(15) These results support the idea that natural remedies could serve as beneficial supplements to orthodontic treatment, particularly for patients who suffer from adverse reactions to conventional chemical mouthwashes.

Although chlorhexidine is widely regarded as the benchmark for effectiveness, recent studies have indicated that herbal mouthwashes, such as those containing Zingiber officinale or Persica, may provide similar outcomes in plaque and gingivitis control, with fewer adverse effects.(9) A meta-analysis by Kommuri et al.(14) compared herbal mouthwashes to those based on chlorhexidine, yielding mixed findings that leaned towards the benefits of herbal alternatives, especially in alleviating gingival inflammation.

Nevertheless, additional clinical trials are needed to confirm the long-term effectiveness and safety of these herbal solutions. It is essential to recognize that employing a combination of mechanical and chemical techniques is likely to yield the best outcomes for orthodontic patients. Informing patients about effective brushing practices and encouraging them to maintain consistent oral hygiene routines is just as important as the use of mouthwashes.

Studies have repeatedly demonstrated that patient motivation plays a significant role in the effectiveness of oral hygiene programs. (1)(7) Additionally, it is crucial for clinicians to remain attentive to oral hygiene throughout orthodontic treatment and to suggest tailored mouthwash routines that consider the patient's specific needs, preferences, and any negative effects related to the treatment. The increasing availability

of over-the-counter mouthwashes with various active ingredients offers patients more options for managing their oral health during orthodontic therapy. (18) (10)

V. CONCLUSION

As a result, chlorhexidine (CHX) is acknowledged as the benchmark in research. Nevertheless, extended use of chlorhexidine may lead to adverse effects, such as extrinsic tooth discoloration and oral tissue pigmentation, which hinder and limit its long-term usage. Despite this, it remains more effective than previously used mouthwashes, including herbal options like Persica, Zingiber officinale essential oil, Aloe Vera extract, Neem extract, Hiora Mouthwash, Listerine, octenidine dihydrochloride (OCT), and cetylpyridinium chloride. Therefore, a promising antimicrobial alternative with reduced side effects would be highly beneficial for treating oral infections. One such alternative is a mouthwash made from liquorice root extract. Liquorice, which refers to the roots and stolons of Glycyrrhiza species, has been utilized for centuries as a traditional herbal treatment.

While no clinical trials involving human orthodontic patients have been conducted, in vitro research has provided evidence that licorice and its active ingredients could serve as promising phytochemicals for creating a new natural treatment for preventing or managing periodontal diseases in orthodontic patients. Licorice can initially target periodontopathogens, which are the primary causative factors of the disease. In fact, a crude extract from *G. uralensis* has been shown to inhibit both the proliferation and biofilm development of *P. gingivalis*, a major etiological agent of chronic periodontitis

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