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Evaluating the Role of Various Mouthwashes as Anti-Plaque Agent During Orthodontic Treatment

Delower Hosen*[1], Rokhshana Islam[2], Ali Hossain Talukder[3], Monwoar Kabir[4], Eng Didarul Islam[5]

[1] *Junior Consultant, Faridpur Medical College Hospital*
[2] *Specialty Registrar (IMT) Cambridge University Hospital UK*
[3] *Junior Consultant, Shaheed Suhrawardy Medical College Hospital Dhaka*
[4] *Assistant Professor, Chittagong Medical College*
[5] *Chemical engineer & Chemical analysts*

ABSTRACT ***Background:*** Dental plaque control is important for maintaining periodontal health, especially in fixed orthodontic patients who are at an increased risk of plaque accumulation due to the presence of brackets, molar bands, buccal tubes, orthodontic implants elastics and wires. Mouthwashes serve as adjuncts to mechanical cleaning methods in reducing plaque levels and improving oral hygiene. This study aims to evaluate the antiplaque activity of various mouthwashes during orthodontic treatment. ***Materials and Methods*:** The descriptive and comparison study took place at the Dhaka Dental College and Hospital in the Department of Orthodontics and Dentofacial Orthopedics. The 84 patients who came to the Department of Orthodontics were split into three groups: Group-1 used saltwater mouthwash, Group-2 used chlorhexidine mouthwash, and Group-3 used essential oil mouthwash. ***Results*:** This group of people had a mean age of 14.1 years. The group was made up of 30 men and 54 women patients. In the salt water group, the mean plaque index number was - 0.58, in the chlorhexidine group, it was -0.296, and in the essential oil group, it was -0.322. ***Conclusion*:** Mouthwash plays a vital function for control of dental plaque during orthodontic therapy. This study employed the use of essential oil, salt water, and chlorhexidine mouthwashes as a antiplaque agent. The efficacy of chlorhexidine surpasses that of essential oil and salt water.

Keywords: Orthodontic Patients, Dental Plaque, Mouthwash, Chlorhexidine, Essential Oil Mouthwash, Salt Water, Oral Hygiene, Plaque Control.

∗**Corresponding author**: Dr. Delower Hosen

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INTRODUCTION

Daily mechanical removal of food debries is the most important prevention strategy for maintain good oral health. However, proper mechanical biofilm control is not performed effectively by the majority of the population, mainly due to lack of motivation and of manual dexterity [1]. Local biofilm retention factors may aggravate home oral hygiene quality. For this reason, patients wearing fixed orthodontic appliances comprise a group that may benefit from the daily use of mouthwashes [2]. Mechanical removal of dental plaque by toothbrushing, flossing, and

using interdental brushes are common methods to maintain oral hygiene [3, 4]. Mouthwashes can be used as adjuncts to mechanical cleaning procedures, due to their ability to reach almost all residual dental plaque and ease of use [5]. The oral health-related ingredients in mouthwashes could be mainly classified as fluoride compounds, anti-microbial agents, or plant extracts [6]. Chlorhexidine (CHX), methylpyridinium chloride (CPC), triclosan-copolymer, and essential oils are regarded as the most effective anti- microbial agents. They are prevalent ingredients in mouthwashes, exhibiting the ability to relieve gingival inflammation [7]. Natural agents are better for children's oral health is on the rise [8]. The anti-gingivitis and anti plaque efficacy of numerous types of mouthwash during orthodontic therapy have been investigated, while controversial results existed [9, 10]. In this study mainly focused on certain types of mouthwash, showing that chlorhexidine mouthwash, essential oil mouthwash, and salt-water mouthwash effectively controlled dental plaque and gingival inflammation [11-13]. However, microbial changes caused by mouthwashes in orthodontic patients have not been fully assessed yet. There is evidence showing that repeated use of antimicrobial Mouthwashes could alter the composition and metabolite profiles of the microbial community toward disease- associated traits and even lead to the development of antiseptic-resistant phenotypes [14, 15]. Thus, caution is required before recommending the use of anti- microbial products [16].

MATERIALS AND METHODS

The descriptive comparative study was conducted in the Department of Orthodontics and Hospital. Total 84 patients attending in the Department of orthodontics were divided into three groups: Group 1: saltwater, Group2: Chlorhexidine mouthwash, Group3: Essential oil mouthwash. They were adviced to brush their teeth twice daily and use mouthwash. Oral hygiene measurements were made before bracket setup and 4 weeks after the observation period using the Loe-Silness plaque indices.

RESULTS

Table 1: Calculation of mean plaque index before bracket setup and after 4 weeks

Plaque index	Group-1 (n=28)		Group-2 (n=28)		P value
	Mean	±SD	Mean	±SD	
Before	0.160	±0.053	0.177	±0.081	0.360^{ns}
After4 weeks	0.741	±0.337	0.473	±0.132	0.001^{s}
Difference	-0.581	±0.326	-0.296	±0.152	0.001^{s}

s =significant, ns =not significant, p value reached from unpaired t-test
Group-1= Saltwater Group 2=Chlorhexidine

Table 1 shows that in before bracket setup, mean plaque index was found 0.160±0.053 in group-1 and 0.177±0.0181 in group-2. After 4 weeks mean plaque index was found 0.741±0.337 in group-1 and 0.473±0.132ingroup-2. Differenceofmeanplaque index was found -0.581±0.326 in group-1 and - 0.296±0.152ingroup-2. After 4 weeks and difference of mean plaque index were statistically significant ($p<0.05$) between two groups

Table 2: Comparison of the difference mean plaque index values between group-1 and group-2

	Differenceof PI		p-value
	Mean	±SD	
Plaque index	0.268	±0.378	0.001

s =significant p value reached from unpaired t-test

Table 2 shows that the mean difference of plaque index between group-1and group-2 is 0.268±0.378, which was statistically significant ($p<0.05$).

Table 3: Calculation of mean before and after 4 weeks study plaque index with age group

Plaqueindex	Age				P value
	n	<15years	n	≥15years	
		Mean±SD		Mean±SD	
Group-1					
Before	16	0.159±0.014	12	0.162±0.013	0.568^{ns}
After4 weeks	16	0.713±0.067	12	0.778±0.122	0.083^{ns}
Group-2					
Before	17	0.177±0.021	11	0.176±0.021	0.903^{ns}
After4 weeks	17	0.433±0.024	11	0.535±0.046	0.001^{s}

In group-2, after 4 weeks mean plaque index was found 0.433±0.024 in age <15 years and 0.535±0.046 in ≥ 15 years, which was statistically significant ($p<0.05$) between two groups.

Table 4: Mean difference plaque index with age

	Difference of PI		p-value
	Mean	±SD	
Group-1			
Before	-0.003	±0.021	0.883
After 4 weeks	-0.065	±0.130	0.621
Group-2			
Before	0.001	±0.032	0.963
After 4 weeks	-0.101	±0.048	0.044

s= significant, ns= not significant p value reached from unpaired t-test.

In group -2, after 4 weeks mean difference of plaque index between age < 15 years group and ≥ 15 years was-0.101±0.048, which was statistically significant ($p<0.05$).

Table 5: Mean difference plaque index with gender

	Difference of PI		p-value
	Mean	±SD	
Group-1			
Before	-0.003	±0.021	0.888^{ns}
After 4 weeks	0.155	±0.126	0.230^{ns}
Group-2			
Before	0.019	±0.031	0.543^{ns}
After 4 weeks	-0.044	±0.050	0.393^{ns}

ns=not significant p value reached from unpaired t-test

In group 1- before bracket setup plaque index difference between male and female was -0.003±0.021, P value was 0.888. After 4 weeks plaque index difference between male and female was 0.155±0.126, p value was 0.230. In group 2- before bracket setup plaque index difference between male and female was 0.019±0.031, P value was 0.543. After 4 weeks plaque index difference between male and female was-0.044±0.050, p value was 0.393.

DISCUSSION

In this study that in before bracket setup, mean plaque index was found 0.160±0.053 in group-1 and 0.177±0.0181 in group-2. After 4 weeks mean plaque index was found 0.741±0.337 in group-1 and 0.473±0.132 in group-2. Difference of mean plaque index was found -0.581±0.326 in group-1 and - 0.296±0.152 in group-2. After 4 weeks and difference of mean plaque index were statistically significant ($p<0.05$) between two groups. Aravinth *et al*., found salt water was as effective as chlorhexidine in reducing dental plaque [17]. This result was similar to the study B. Fomete *et al*., ,mentioned that Chlorhexidine, warm salt water and warm tap water averagely produced the same number of colony forming units of bacteria, which shows that the three different mouth washes are equally effective as post-operative mouth rinses after oral surgery But a different result found in a study conducted byGupta *et al*.,which evaluated the effect of aloe vera Mouthwash with chlorhexidine and saline as the placebo on dental plaque, concluded that saline rinse was not as effective as aloe vera and chlorhexidine [18, 19]. In present study observed that the mean difference of plaque index between group-1 and group-2 was 0.268±0.378, which was statistically significant ($p<0.05$). CHX is considered gold standard among antimicrobial agents which has been constantly evaluated chemical agent for the reduction in the formation of plaque and plaque-induced gingival inflammation [20]. Positively charged CHX moleculeis rapidly attracted to bacterial cell membrane that is negatively charged resulting in the damage and leakage of intracellular components is considered its antibacterial mode of action [21]. Gunsolley, showed that a0.2% chlorhexidine-based rinsing solution was effective in anti plaque activity and gingival indices in orthodontically treated patients. CHX has also anticaries and anti-plaque activity [22-24]. Anderson *et al*. conducted a study in 1997over 30 adolescence for assess the Clinical effects of chlorhexidine mouthwashes on patients undergoing orthodontic treatment [25]. The data indicated that the use of CHX in addition to regular oral hygiene habits, was effective in reducing plaque and gingivitis in adolescents undergoing orthodontic treatment. In our study we found significant role of chlorhexidine mouthwash. In group-2, after 4 weeks mean difference of plaque index between age<15years group and ≥15 years was -0.101±0.048, which was statistically significant ($p<0.05$).So there was in significant correlation between age and plaque score. Which was similar with the study of Cahen *et al*., Memon *et al*., [27]. This finding was in contrast with the study results of Kudirkaite*etal*., Mei *et al*., [28, 29]. Krupinska-Nanys and Zarzecka found significant difference between older and younger age group. In group 1- before bracket setup plaque index difference between male and female was -0.003±0.021, P value was 0. 888.After 4 weeks plaque index difference between male and female was 0.155±0.126, p value was 0.230 [30]. In group 2- before bracket setup plaque index difference between male and female was 0.019±0.031, P value was 0.543. After 4 weeks plaque index difference between male and female was-0.044±0.050, p value was 0.393.The findings of this study were in agreement with the study of Attasi and Awartani [21]. Memon *et al*., [27]. But some other researchers Kudirkaite *et al*., [28]. Mei *et al*., [29]. Krupinska-Nanys and Zarzecka, found significant difference between male and female. They mentioned female patients were more concern about oral hygiene maintenance [30-34].

CONCLUSION

Mouthwash plays a key role in controlling plaque during orthodontic treatment. This study found that chlorhexidine was more effective than essential oil and salt water in reducing plaque. After 4 weeks of bracket placement, plaque accumulation increased in both groups, with better control observed in group 2. Age significantly affected plaque levels, while gender had no significant impact.

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