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A Comparative Analysis of Various Mouthwashes in Managing Dental Plaque among Orthodontic Patients

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Abstract **Original Research Article**

***Background*:** Fixed orthodontic appliances have been found to contribute to an increased accumulation of dental plaque, hence making it more challenging for patients to effectively brush their teeth. Consequently, guidance provided by the orthodontist regarding oral hygiene, together with patient motivation pertaining to tooth brushing and utilization of mouthwash, assume significant significance. ***Objective*:** To assess the comparative effectiveness of various mouthwashes in managing dental plaque among orthodontic patients, a study was conducted. ***Materials and Methods*:** The descriptive and comparison study took place from December 2017 to October 2018 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: There is a salt water mouthwash, a chlorhexidine mouthwash, and an essential oil mouthwash in the third group. ***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 crucial function in the management of dental plaque during orthodontic therapy. This study employed the use of essential oil, salt water, and chlorhexidine mouthwashes as interventions for the management of dental plaque. The efficacy of chlorhexidine in plaque management surpasses that of essential oil and salt water.

Keyword: Chlorhexidine, oral microbes, plaque, salt water, Orthodontics.

INTRODUCTION

Properly performed daily mechanical biofilm control is the most important prevention strategy for periodontal diseases. 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 [1].

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), cetylpyridinium 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, 8]. The anti- gingivitis and anti-microbial 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 organic 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 anti-microbial 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 generic anti-microbial products [16].

MATERIALS AND METHODS

The descriptive comparative study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, Dhaka Dental College and Hospital, Dhaka during December 2017 to October 2018. Total 84 patients attending in the Department of orthodontics were divided into three groups: Group 1: saltwater, Group 2: Chlorhexidine mouthwash, Group 3: 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.

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}
After 4 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= Salt water
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±0.132 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.

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

	Difference of 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-1 and 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

Plaque index	Age				P value
	n	<15 years Mean±SD	n	≥15 years Mean±SD	
Group-1					
Before	16	0.159±0.014	12	0.162±0.013	0.568^{ns}
After 4 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}
After 4 weeks	17	0.433±0.024	11	0.535±0.046	0.001^{s}

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

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*., [17], found salt water was as effective as chlorhexidine in reducing dental plaque. This result was similar to the study B. Fomete *et al*., [18], 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 by Gupta *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 [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 molecule is 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 [22], showed that a 0.2% chlorhexidine-based rinsing solution was effective in controlling plaque and gingival indices in orthodontically treated patients. CHX has also anti caries and anti-plaque activity [23, 24]. Anderson *et al*., [25], conducted a study in 1997over 30 adolesence for assess the Clinical effects of chlorhexidine mouthwashes on patients undergoing orthodontic treatment. 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 <15 years group and ≥15 years was -0.101±0.048, which was statistically significant ($p<0.05$). So there was insignificant correlation between age and plaque score. Which was similar with the study of Cahen *et al*., [26], Memon *et al*., [27]. This finding was in contrast with the study results of Kudirkaite *et al*., [28], Mei *et al*., [29]. Krupinska-Nanys and Zarzecka [30], 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. 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 [30], found significant difference between male and female. They mentioned female patients were more concern about oral hygiene maintenance.

CONCLUSION

Mouthwash helps control tooth plaque during orthodontic treatment. This study controlled dental plaque with essential oil, salt water, and chlorhexidine mouthwashes. Chlorhexidine controlled plaque better than essential oil and salt water.

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