http://doi.org/10.33279/jkcd.v13i04.632

COMPARATIVE EFFICACY OF CHLORHEXIDINE AND SODIUM BICARBONATE DENTIFRICES IN PLAQUE AND GINGIVAL INFLAMMATION REDUCTION: A RANDOMIZED CONTROLLED TRIAL

Zuhra Akhtar[1], Kawish Syed[1], Afaq Farooq[1], Gulalai[1], Abdul Muneeb[2], Zain Ayub[1], Abid Rahim[1]

[1]Department of Periodontology, Sardar Begum Dental College, Gandhara University- Peshawar
[2]Private Dental Practitioner

ABSTRACT

Objectives: *To determine the efficacy of Chlorhexidine dentifrice compared to Sodium Bicarbonate dentifrice in plaque and gingival Inflammation reduction.*

Materials and Methods: *From May 2022 to August 2022, a randomized controlled experiment was carried out in the Periodontology Department of Sardar Begum Dental College and Hospital Peshawar. Using WHO formulae for sample size, 98 patients were selected. The age range of the patient was chosen between 13-40 years. The mean age presentation was 19.7 ± 4.9 years. The females were N=56 (57.1%) predominant than males N=42 (42.9%). The patients were placed into two groups of 49 each. Group A received dentifrice containing chlorhexidine, whereas Group B received dentifrice containing sodium bicarbonate. The data was entered into a structured proforma. SPSS 22.0 was used to analyze data. The Chi-Square test was used to compare the means of the two groups. Values of ≤ .05 were considered significant.*

Results: *The mean plaque scores for both groups are shown in Table 7. Group A (Chlorhexidine group) participants had an initial mean plaque score of 2.7, while the plaque score after the intervention was 1.2. The initial mean plaque score was 2.7 in the participants of group B (Sodium Bicarbonate group), while the mean plaque score after intervention was 1.75. This shows that both dentifrices reduced plaque but chlorhexidine was more effective than sodium bicarbonate in plaque reduction. Similarly, both (Chlorhexidine and Sodium Bicarbonate) reduced the gingival index score, but chlorhexidine was more effective than sodium bicarbonate in reducing gingival inflammation.*

Conclusion: *Both the dentifrices show a significant reduction in both the plaque scores and gingival scores after usage. Chlorhexidine group showed a notable reduction in plaque and gingival scores as compared to sodium bicarbonate.*

Key words: *Dental plaque, oral hygiene, mouthwash, indices, bleeding on probing.*

INTRODUCTION

For every individual health is a valued resource. The quality of life is significantly impacted by oral health, which is a crucial aspect of overall health. To maintain and enhance oral health, plaque must be removed from the teeth and the surrounding gingival tissue, and plaque accumulation must be prevented. Gingivitis can be prevented using mechanical and chemical plaque control[1].

The most common method of maintaining oral hygiene for individuals is by brushing their teeth. Brushing with a toothbrush and other mechanical cleaning techniques have been demonstrated to be effective ways to control plaque when done properly

Correspondence:
Abid Rahim
Senior Registrar,
Department of Periodontology, Sardar Begum Dental College, Gandhara University- Peshawar
Email: abidrahim@asia.com

and frequently[2]. A fluoride dentifrice should be used to brush twice daily for two minutes, according to all Dental Care Professionals (DCPs)[3].

The term "dental plaque" refers to a polymicrobial biofilm made up of many bacterial complexes that benefit from adhesion, metabolic interactions, and coaggregation[4]. The two most frequent plaque-related periodontal conditions are gingivitis and periodontitis. Gingivitis is a non-destructive inflammation that is usually reversible if dental plaque is controlled[5]. Periodontitis is distinguished by the presence of predisposing factors, both genetic and environmental and results in irreversible loss of attachment and tooth loss as a result of continuous local inflammation caused by periodontopathic bacteria[6]. Several systematic reviews have also linked the timing and type of orthodontic intervention to the deterioration of clinical parameters indicative of periodontal diseases, such as plaque index (PI), bleeding on probing (BOP), clinical attachment loss (CAL), and the development of pockets or gingival recession, with various degrees of reversibility following interventions[7].

Periodontal problems in orthodontic patients can be linked back to a greater challenge to maintain oral hygiene, and plaque retention because of orthodontic appliances, under orthodontic stresses, there are bone/periodontal movements and remodeling that promote the buildup of supragingival and subgingival plaque and increase the periodontal pathogenic potential[8,9].

Chlorhexidine is commonly employed as a positive control in studies and is regarded as the "gold standard" for oral antiseptics[10]. It acts as an antibacterial and antiplaque agent by compromising the cell membrane's integrity[6]. The chlorhexidine's excellent protein binding ability results in high substantivity and effectiveness in biofilm formation. Due to dose-dependent side effects such as tooth discoloration and taste disruption, high Chlorhexidine (CHX) concentrations are frequently restricted to short-term usage[10], sloughing off oral mucosa[11], calculus formation[12], and fibroblast damage[13].

Sodium bicarbonate is commonly known as baking soda (NaHCO3). It penetrates the plaque layer and disrupts the sticky polysaccharide matrix, thus weakening the plaque's structural integrity[14], and thus facilitating the physical removal of plaque [14,15].

Both chemical agents, that is chlorhexidine and sodium bicarbonate show anti-inflammatory and anti-bacterial properties[11,16,17]. However, Chlorhexidine has several side effects such as; burning sensation, dry mouth, teeth staining, altered taste, sloughing of the oral mucosa[11], calculus formation[12], and fibroblast damage[13], hence should not be used for more than three months. Sodium bicarbonate has the same properties as chlorhexidine but has fewer side effects and is generally considered safe to use[11,18]. The primary factor for gingivitis and periodontitis is plaque. There is an increase in plaque accumulation during orthodontic intervention because of plaque retentive factors. Effective dentifrice which can inhibit plaque accumulation and promote gingival health, with minimal side effects is needed. Both sodium bicarbonate and chlorhexidine have antiplaque and anti-inflammatory action, but chlorhexidine cannot be used for the long term because of its side effects, the main side effect being that it damages the fibroblast, an essential factor in reattachment. Also brushing with sodium bicarbonate was more pronounced at the less accessible site. The main aim of the study is to compare and assess the plaque scores and gingival index scores in orthodontic patients following two times daily usage of 0.12% chlorhexidine and 67% sodium bicarbonate after 6 weeks.

MATERIALS AND METHODS

This randomized control trial was conducted in the Department of Periodontology, Sardar Begum Dental College and Hospital, Peshawar from May 2022 to August 2022. Ethical approval was obtained from the Ethical Committee, Gandhara University (29th meeting). A total of 98 participants were selected for this study by using the WHO sample size calculator. Participants were divided into two groups with 49 participants in each group. Inclusion criteria of (participants aged 13 to 40 years, BPE code 1,2, patients wearing brackets for more than 3 months, presence of ≥ 20 teeth, generally in good health and condition) and exclusion criteria of (usage of any mouthwash or antibiotic within 7 days of baseline, pregnant or lactating patients, premedication is required to conduct periodontal examinations and intervention, 3 weeks before baseline exams, dental prophylaxis was performed, smokers, patients on long-term anti-inflammatory drugs, systemic diseases like cardiovascular diseases, pulmonary, liver, diabetes, or cerebral diseases, and antimicro-

bial intervention in the past 3 months) were strictly followed for participants recruitment.

After approval of the study from the Ethical Committee of Gandhara University in its 29th meeting, patients who met the study's inclusion requirement were enrolled in it. Data were collected from patients who will visit the Department of Periodontology SBDC. Participants selected were allocated into two groups randomly, the first group (A) was given chlorhexidine group/CHX (Control group) and the second group (B) was given sodium bicarbonate/ NaHCO3 (Test group). The study and

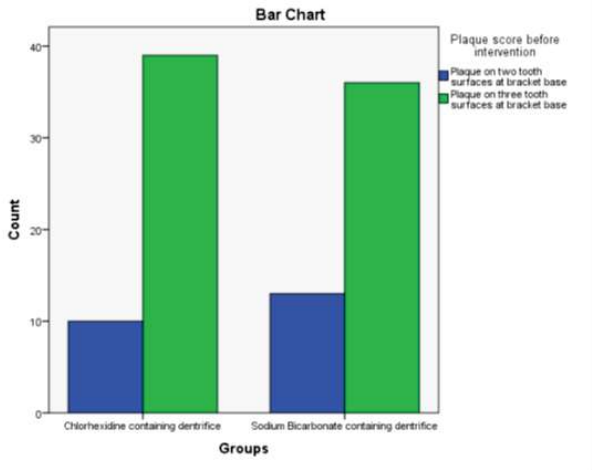

Fig 1: Plaque scores before intervention

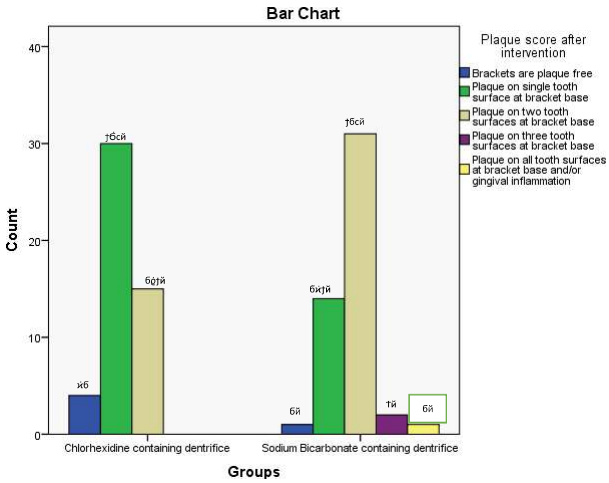

Fig 2: Plaque scores after intervention

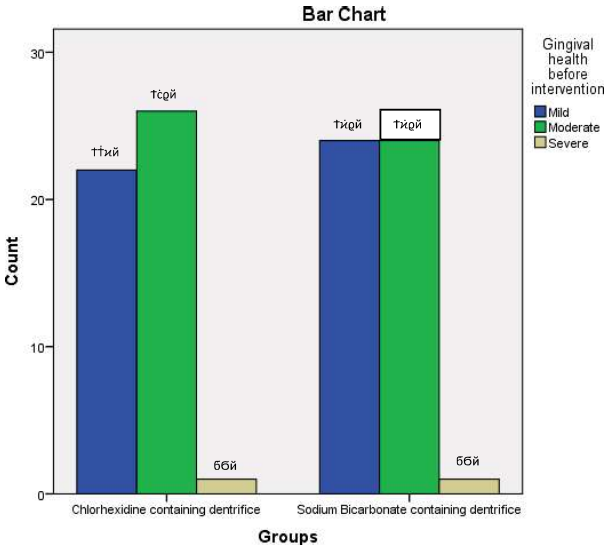

Fig 3: Gingival Health Before Intervention

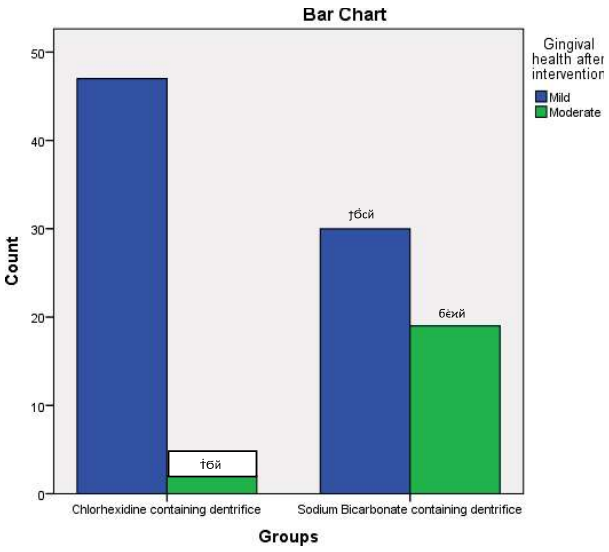

Fig 4: Gingival Index After Intervention

Table 1: Mean Plaque Index and Gingival Index

Groups		Plaque score before intervention	Plaque score after intervention	Gingival index before intervention	The gingival index after intervention
Chlorhexidine containing dentifrice	Mean	2.7959	1.2245	1.5714	1.0408
	N	49	49	49	49
	Std. Deviation	0.40721	0.58685	0.54006	0.19991
Sodium Bicarbonate containing dentifrice	Mean	2.7347	1.7551	1.5306	1.3878
	N	49	49	49	49
	Std. Deviation	0.44607	0.66240	0.54398	0.49229

control groups were chosen using a lottery system. Because of the double-blind nature of the study, neither the participants nor the researchers were aware of their group assignment.

Written informed consent was taken from all patients. After giving plaque-disclosing tablets, the Plaque Index (PI) and the Gingival Index (GI) were recorded in both groups. Group (A) was given chlorhexidine dentifrice, while group (B) was given sodium bicarbonate dentifrice (names masked). Both dentifrices were used twice daily for 6 weeks by the patients. Recall visits were done at 3 weeks and the end of the sixth week. During these recall visits, reinforcement of oral hygiene was given and any change in health or medical status was recorded. Patients were told to solely use the dentifrices and toothbrushes given to them and refrain from using any other methods of plaque control. Identification of the tubes containing mouthwash was masked till the end of the study. At the end of the study, the parameters were assessed and compared to the baseline.

The impact of confounding factors such as the toothbrush type and type of brushing technique was avoided by giving the same type of toothbrush and advising the same type of brushing technique (charter's technique) to all the participants. Both groups of patients received instructions to brush their teeth twice a day for two minutes.

SPSS 22.0 was used for data analysis. Descriptive statistics like mean and standard deviation (SD) were applied for age. Frequency and percentage were applied for gender. Paired t-test was used to find statistical significance, set at 0.05.

RESULT

Out of total 98 participants, the age ranges from 13 to 40 years. Females outnumbered males with N=56 (57.1%) and N=42 (42.9%) respectively with 49 patients in group A (CHX) and 49 patients in group B (sodium bicarbonate).

The initial mean plaque score was 2.7 in participants of group A (CHX group). The mean plaque score after intervention becomes 1.2. This shows a decline of 1.5 after intervention with chlorhexidine. Similarly, the initial mean plaque score was 2.7 in the participants of group B (NaHCO3 group). The mean plaque score after the intervention was 1.75.

The initial mean gingival index score was 1.57 in group A (CHX group) participants. The mean plaque score after intervention becomes 1.04. This shows a decline of 0.53 after intervention with chlorhexidine. The initial mean gingival index score was 1.53 in the participants of group B (NaHCO3 group), while the mean gingival index score after intervention was 1.38. Overall, the mean decline in plaque scores and gingival index before and after the intervention was higher in the CHX group (group A) compared to the NaHCO3 group (group B) (table 5).

In group A percentage plaque score before intervention was 10.2% plaque on two tooth surfaces at the base of the bracket and 39.8% plaque on three tooth surfaces at the base of the bracket. In group B percentage plaque score before intervention was 13.3% plaque on two tooth surfaces at the base of the bracket and 36.7% plaque on three tooth surfaces at the base of the bracket (Table 1, Fig. 1). Table 2 (Fig. 2) shows the percentage plaque score after intervention. In group A, 4.1% of brackets had no plaque, 30.6% plaque on a single tooth surface at the base of the bracket, 15.3% plaque on two tooth surfaces at the base of the bracket and 0% plaque on three and all tooth surfaces at the base of the bracket. In group B, percentage plaque scores after intervention were that 1% of brackets had no plaque, 14.3% plaque on single tooth surface at the base of the bracket, 31.6% plaque on two tooth surfaces at the base of the bracket, 2% plaque on three tooth surfaces at the base of the bracket, 1% plaque on all tooth surfaces at the base of the bracket.

Table 3 shows the percentage of the gingival index before intervention. In group A percentage of the gingival index before intervention was 22.4% mild gingivitis and 1% severe gingivitis. In group B gingival index percentage was 24.5% mild, 24.5% moderate, and 1% severe. Table 4 shows the percentage of the gingival index after intervention. In group A 48% had mild gingivitis and 2% had moderate gingivitis. In group B after intervention, Gingival Index was 30.6% mild and 19.4% moderate.

DISCUSSION

The study was conducted at the Periodontology Department to compare the significance of chlorhexidine dentifrice and sodium bicarbonate dentifrice in patients undergoing fixed orthodontic therapy in terms of accumulation of plaque and gingival health.

The oral environment is modified during orthodontic intervention with fixed appliances[19]. Plaque builds up more around brackets and bands, the oral microflora changes, and patients have increased difficulty cleaning. Without preventative measures, gingival inflammation, plaque buildup, and enamel decalcification surrounding fixed appliances may occur[20]. White spots, hyperplastic gingivitis, periodontal disease, and carious lesions are all caused by dental plaque. Due to the development of sites that retain plaque, notably in the spaces between the brackets, bands, and ligatures and along the gingival edges, fixed orthodontic appliances lead to higher plaque buildup. Dental plaque must be controlled and removed in orthodontic patients to maintain good oral health[21]. Despite these facts, little research has been done on orthodontic biofilm management strategies.

The average age of the participants in the research was 19.7 ± 4.9 years, indicating that more patients were adults of both sexes. This study opposes the study done by Akwagyiram et al[22] in which the mean age presentation was 34.5 years. This may be because in teenage and early adulthood individuals are more cautious about their esthetics and features. The present study shows the predominance of females. Females outnumbered males with N=56 (57.1%) and N=42 (42.9%) respectively. The study conducted by Cheng HC et al (154) also demonstrated an increased number of females than males. The study conducted by Alavi S and colleagues[23] showed equal distribution of both males and females in their study.

The study shows a reduction in the mean percentage of plaque score and gingival index score after giving chlorhexidine dentifrice and sodium bicarbonate dentifrice but a higher decrease occurred in those who received chlorhexidine dentifrice than in those who received sodium bicarbonate dentifrice. The results of the study are consistent with the study carried out by Slot et al[12] in which they compared chlorhexidine dentifrice with placebo dentifrice and checked the parameter gingival index, plaque score, bleeding score, and sensitivity index were consistent with the current study.

Ghassemi A and colleagues[24] conducted a study in which the mean plaque score reduction with baking soda is 0.47 ± 0.21 with a p-value of 0.001. The results are consistent with the present study which is significant with a p-value of 0.001.

Another study was done by Slot et al[25] to check the efficacy of 0.12% chlorhexidine dentifrice on plaque accumulation. The results of which contradict the present study. With a p-value of 0.006, the study's findings were not statistically significant.

Pannuti CM and colleagues[26], researched to examine the clinical impact of herbal dentifrice on the prevention and intervention of plaque and gingivitis. They checked the PI and GI. With a p-value of 0.73, the dentifrice was unable to significantly decrease the plaque. With a p-value of 0.001, there was a statistically significant decrease in Gl. Their results of the study were in accordance with the study with respect to GI but not with respect to PI. The reason might be due to the fact that the study duration was 21 days while the present study duration is 6 weeks.

The study conducted by Al Shammeri, et al[27] concluded that sodium bicarbonate dentifrice significantly reduces both Plaque Index and Gingival Index scores but the effect is short term and more studies are needed to assess its efficacy as an antiplaque and anti-gingivitis agent over 6 months.

In a study conducted by Mason and colleagues[28], they compared 67% NaHCO3; 0% NaHCO3, and stannous F; or 0% NaHCO3 plus CHX. The 67% NaHCO3 dentifrice considerably outperformed the two 0% NaHCO3 dentifrices in terms of improvements to the mean TPI score (p-value 0.001 for both comparisons). The results of this study contradict the present study.

A study was carried out by Lomax et al[29] in which they checked the effectiveness of 67% NaHCO3 dentifrices on gingivitis. They checked the parameters gingival index, and bleeding index. There was a statistically significant decrease in all parameters. The results of GI were similar to the present research.

CONCLUSION

Both the dentifrices show a significant reduction in both gingival index and plaque index after 6 weeks of usage. Sodium bicarbonate is recommended because it is generally safer to use and has no side effects as compared to chlorhexidine dentifrice. More research is needed to evaluate how effective it is an anti-gingivitis and antiplaque agent over a three- to six-month period.

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