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Comparative Evaluation of Different Mechanical Plaque Control Methods in patients undergoing Fixed Orthodontic Therapy: A RetrospectiveStudy

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ABSTRACT
Aim: To retrospectively evaluatethree commercially availablemechanical plaque control methods in patients undergoing fixed orthodontic therapy. It was a comparative study which involved assessment of efficiencies of three tooth brushes those specially designed for orthodontic purpose.
Materials and Methods: Total 30 patients (age range 14 to 24) were studied in which 16 were females and 14 were males. Patients were studied into three groups of ten each as per three commercially available orthodontic brushes. Group one patients used Oral B Orthodontic toothbrush. Group two patients used Thermoseal Ortho Brush. Group three patients used Colgate Slim Soft Ortho Toothbrush. The horizontal scrub method was shown to all patients to clean their teeth for 2 minutes for at least twice a day. Evaluation of plaque control and efficiency of particular brushing system was done by estimating plaque index and gingival index. All patients were evaluated for these indexes after one month, two months and three months of brushing.
Results: Statistical analysis was done using Statistical Package for Social Sciences (SPSS). After one month of brushing with Oral B Orthodontic toothbrush, mean plaque index was 0.411 ± 0.023. After two months it was 0.352 ± 0.026 and after three months of brushing it was 0.281 ± 0.012. P value was significant for evaluation after three months in group 1. After one month of brushing with Thermoseal Ortho Brush, mean plaque index was 0.465 ± 0.021. After one month of brushing with Colgate Slim Soft Ortho Toothbrush, mean plaque index was 0.235 ± 0.024. After two months it was 0.184 ± 0.010 and after three months of brushing it was 0.109 ± 0.013.
Conclusion: Authors stated that all three brushing systems were effective in plaque control and maintaining gingival health however, Colgate Slim Soft Ortho Toothbrush was identified as most efficient amongst all three tested systems for reducing plaque and maintaining optimal gingival health in orthodontic patients.
Keywords: Fixed Orthodontic Treatment, Oral Hygiene, Plaque, Toothbrush

INTRODUCTION

Dental esthetics isone of the key factors which attracts patient to undertake orthodontic treatment. Orthodontic treatment ensures correct alignment of the teeth and improves the occlusal and jaw relationship. Therefore, it ultimately aids in enhanced mastication, speech, and facial esthetics.[1,2] Periodontal problems are identified as most common consequence of orthodontic treatment. This is particularly true since patients are unable to perform brushing.This relative incapability of the orthodontic patient to clean oral cavity effectivelyis primarily due to the hindrance of braces.[3,4]All these eventually lead to development of gingivitis. Gingivitis is clinically identified by

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inflammation, redness, and bleeding on probing. Gingivitis as well as gingival enlargement appeared to be the most common temporaryconsequence of orthodontic treatments on the overall oral health.[5] Many of the researchers in the literature have confirmed that almost all patients with fixed orthodontic treatment get gingivitis at some point during the treatment.[6,7]Nevertheless, despiteadvisingproper instructions by orthodontist, many of the orthodontic patients generallyfail to maintain a satisfactory standard of plaque control.Universal and most popular method of plaque control is mechanical and chemical methods. However, chemical plaque control methods must not be employed solo.[8,9]Chemical plaque control must be added in combination with mechanical plaque control methods. Many companies of oral hygiene products have specially designed tooth brushes for orthodontic needs. Nonetheless, before advising these brushes to any orthodontic patient, clinician must be well aware of all associated pros and cons. Therefore, this retrospective evaluation was attempted using three commercially available mechanical plaque control methods in patients undergoing fixed orthodontic therapy. It was a comparative study which involved assessment of efficiencies of three tooth brushes those specially designed for orthodontic use.

MATERIALS AND METHODS

The present study was planned and conducted in the Department of Orthodontics of the institute in which 30 orthodontics patientswere studied. Out of 30 patients, 16 were females and 14 were males. A written informed consent was obtained from each patient after explaining them the procedure of the study.Randomized sampling was employed for precise selection of patients. All selected patients were in the age range of 14 to 24 years wherein orthodontic treatment was going on for different diagnosis. Absolute inclusion criteria included total absence of any underlying systemic disease, absence of tmj disorders and healthy intraoral conditions, patients receiving lingual orthodontic therapy, absence of caries or enamel demineralization, absence of any ongoing antibiotic therapy. Patients were studied into three groups of ten each as per three commercially available orthodontic brushes. Group one patients have been asked to use Oral B Orthodontic toothbrush. Oral B Orthodontic toothbrush (Procter & Gamble, Sandton, Johannesburg, South Africa) uses V-shaped bristles to eliminate plaque from braces and teeth. It may be utilized as a braces toothbrush or as a brush to clean wires and brackets associated with retainers, headgear and other types of orthodontic work. Group two patients have been asked to use Thermoseal Ortho Brush. Thermoseal Ortho Brush (ICPA Health Products Ltd, Mumbai, India) is an efficiently designed orthodontic brush with soft bristles. These bristles softly massage the gingiva and cleans tooth surface, while eliminating plaque from the gingival margins. Group three patients have been asked to use Colgate Slim Soft Ortho Toothbrush. Colgate Slim Soft Ortho Toothbrush (Colgate Oral Pharmaceuticals, Park Avenue, New York, USA) is designed with u-shaped bristles to help improve cleaning around brackets. All three brushes were given to participating patients after commencement of three month of fixed orthodontic treatment. Orthodontic toothbrushes were distributed amongst all patients as per groupings. The horizontal scrub method was demonstrated to all patients to clean their teeth for 2 minutes for at least twice a day. All patients were instructed to avoid any eating or drinking immediately after brushing. Assessment of plaque control and efficiency of particular brushing system was done by estimating plaque index and gingival index.Gingival index was estimated by putting Williams probe in to gingival sulcus and gentle running around and inter-proximal regions of teeth. Any sign of bleeding within ten second will indicate positivity. Plaque index was estimated by putting Williams probe in between bracket base and free gingival margin at six sites around every tooth. All patients were evaluated for these indexes after one month, two months and three months of brushing. Data was recorded and interpreted accordingly.

RESULTS

The statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 22.0 for windows (SPSS Inc., 233 South Wacker Drive, 11th Floor, Chicago, IL) statistical analysis software. The base data was subjected to suitable statistical tests to obtain p values, mean, standard deviation, chi- square test, standard error and 95% CI. A p-value <0.05 was taken as statistically significant. Table 1 is depicting fundamental statistical illustration with level of significance evaluation using pearson chi-square test [for plaque index in group 1]. After one month of brushing with Oral B Orthodontic toothbrush, mean plaque index was 0.411 ± 0.023. After two months it was 0.352 ± 0.026 and after three months of brushing it was 0.281 ± 0.012. P value was significant for evaluation after three months in group 1. So it is very obvious that continuous using of Oral B Orthodontic toothbrush considerably reduces plaque. Table 2 is depicting fundamental statistical illustration with level of significance evaluation using pearson chi-square test [for gingival index in group 1]. After one month of brushing with Oral B Orthodontic toothbrush, mean gingival index was 0.365 ± 0.021. After two months it was 0.276 ± 0.002 and after three months of brushing it was 0.211 ± 0.034. P value was significant for evaluation after three months in group 1. Therefore it was very clear that continuous using of Oral B Orthodontic toothbrush considerably increases

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gingival health. Table 3 is showing essential statistical illustration with level of significance evaluation using pearson chi-square test [for plaque index in group 2]. After one month of brushing with Thermoseal Ortho Brush, mean plaque index was 0.465 ± 0.021. After two months it was 0.382 ± 0.012 and after three months of brushing it was 0.356 ± 0.014. P value was significant for evaluation after three months in group 2. Consequently it was very evident that continuous using of Thermoseal Ortho Brush considerably reduces plaque. Table 4 is demonstrating elementary statistical illustration with level of significance evaluation using pearson chi-square test [for gingival index in group 2]. After one month of brushing with Thermoseal Ortho Brush, mean gingival index was 0.492 ± 0.023. After two months it was 0.450 ± 0.005 and after three months of brushing it was 0.398 ± 0.004. P value was significant for evaluation after one month period in group 1. Thus it was very comprehensible that continuous using of Thermoseal Ortho Brush significantly increases gingival health. Table 5 is describing necessary statistical illustration with level of significance evaluation using pearson chi-square test [for plaque index in group 3]. After one month of brushing with Colgate Slim Soft Ortho Toothbrush, mean plaque index was 0.235 ± 0.024. After two months it was 0.184 ± 0.010 and after three months of brushing it was 0.109 ± 0.013. P value was significant for evaluation after two and three months in group 3. Therefore it was very marked that constant using of Colgate Slim Soft Ortho Toothbrush noticeably reduces plaque formation. Table 6 is representing basic statistical illustration with level of significance evaluation using pearson chi-square test [for gingival index in group 3]. After one month of brushing with Colgate Slim Soft Ortho Toothbrush, mean gingival index was 0.280 ± 0.013. After two months it was 0.224 ± 0.015 and after three months of brushing it was 0.192 ± 0.003. P value was not significant in group 3. Hence, it was very understandable that continuous using of Colgate Slim Soft Ortho Toothbrush appreciably increases gingival health.

Table 1: BASIC STATISTICAL ILLUSTRATION WITH LEVEL OF SIGNIFICANCE EVALUATION USING PEARSON CHI-SQUARE TEST [FOR PLAQUE INDEX IN GROUP 1]

Time (After Brushing)	Group 1 Oral B Orthodontic toothbrush						
	n	Mean PI	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square	Level of Significance (p value)
1 Month	**10**	0.411 ± 0.023	0.930	0.973	1.96	1.425	0.036
2 Months	**10**	0.352 ± 0.026	0.644	0.390	1.12	1.103	0.900
3 Months	**10**	0.281 ± 0.012	0.487	0.927	1.09	1.341	0.001*
							***p<0.05 significant**

Table 2: BASIC STATISTICAL ILLUSTRATION WITH LEVEL OF SIGNIFICANCE EVALUATION USING PEARSON CHI-SQUARE TEST [FOR GINGIVAL INDEX IN GROUP 1]

Time (After Brushing)	Group 1 Oral B Orthodontic toothbrush						
	n	Mean GI	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square	Level of Significance (p value)
1 Month	**10**	0.365 ± 0.021	0.039	0.526	1.96	1.039	0.070
2 Months	**10**	0.276 ± 0.002	0.536	0.928	1.45	1.424	0.500
3 Months	**10**	0.211 ± 0.034	0.039	0.048	1.06	1.049	0.002*
							***p<0.05 significant**

Table 3: BASIC STATISTICAL ILLUSTRATION WITH LEVEL OF SIGNIFICANCE EVALUATION USING PEARSON CHI-SQUARE TEST [FOR PLAQUE INDEX IN GROUP 2]

Time (After Brushing)	Group 2 Thermoseal Ortho Brush						
	n	Mean PI	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square	Level of Significance (p value)
1 Month	**10**	0.465 ± 0.021	0.031	0.029	1.96	1.637	0.080

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2 Months	**10**	0.382 ± 0.012	0.847	0.729	1.02	1.039	0.100
3 Months	**10**	0.356 ± 0.014	0.646	0.002	1.01	1.424	0.001*
							***p<0.05 significant**

Table 4: BASIC STATISTICAL ILLUSTRATION WITH LEVEL OF SIGNIFICANCE EVALUATION USING PEARSON CHI-SQUARE TEST [FOR GINGIVAL INDEX IN GROUP 2]

Time (After Brushing)	Group 2 Thermoseal Ortho Brush						
	n	Mean GI	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square	Level of Significance (p value)
1 Month	**10**	0.492 ± 0.023	0.038	0.324	1.96	1.827	0.001*
2 Months	**10**	0.450 ± 0.005	0.827	0.626	1.04	1.029	0.900
3 Months	**10**	0.398 ± 0.004	0.002	0.005	1.62	1.013	0.060
							***p<0.05 significant**

Table 5: BASIC STATISTICAL ILLUSTRATION WITH LEVEL OF SIGNIFICANCE EVALUATION USING PEARSON CHI-SQUARE TEST [FOR PLAQUE INDEX IN GROUP 3]

Time (After Brushing)	Group 3 Colgate Slim Soft Ortho Toothbrush						
	n	Mean PI	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square	Level of Significance (p value)
1 Month	**10**	0.235 ± 0.024	0.827	0.726	1.96	1.028	0.090
2 Months	**10**	0.184 ± 0.010	0.038	0.931	1.82	1.042	0.001*
3 Months	**10**	0.109 ± 0.013	0.678	0.071	1.64	1.029	0.002*
							***p<0.05 significant**

Table 6: BASIC STATISTICAL ILLUSTRATION WITH LEVEL OF SIGNIFICANCE EVALUATION USING PEARSON CHI-SQUARE TEST [FOR GINGIVAL INDEX IN GROUP 3]

Time (After Brushing)	Group 3 Colgate Slim Soft Ortho Toothbrush						
	n	Mean GI	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square	Level of Significance (p value)
1 Month	**10**	0.280 ± 0.013	0.029	0.427	1.96	1.029	0.600
2 Months	**10**	0.224 ± 0.015	0.024	0.938	1.52	1.052	0.100
3 Months	**10**	0.192 ± 0.003	0.025	0.036	1.69	1.021	0.080

DISCUSSION

Literature has well evidenced that maintenance of oral hygiene has great role in orthodontic therapy. Several studies have been conducted in the past few decades on its importance. Patientsundergoing fixed orthodontic treatment usually encounternoteworthy changes in the oral cavity because of accumulation of food particles within the teeth and orthodontic braces.[10,11] These phenomenon usuallyenhance plaque developmentbecause fixed appliances hampersufficient cleaning by mechanical plaque control methods. Infection and inflammation of gingiva and enamel decalcification surrounding fixed appliances are very common complications.[12,13]Many of the pioneer workers have already suggested that patient undergoing fixed orthodontic treatment must perform brushing and flossing after

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meals. Such procedures can be efficiently achieved by toothbrush with soft bristles.Additionally, it is very imperative to get the floss under the wire that attaches the brackets together.[14,15] The most popular and universal method of plaque control is manual tooth brushing. However, during fixed orthodontic treatment, bands,brackets, buccal tubes, cleats, ligature wires, coil springs,arch wires, and elastics are positioned on the tooth surface.All these hindrances eventually lead to inefficient removal of food particles. Subsequently, oral hygienemaintenance becomes difficult. The orthodontic appliance onthe tooth surface usually acts as retentive area forthe potential accumulation of dental plaque.[16,17]By definition, dental plaque is a structurally and functionallyorganized biofilm which is the prime cause of dental caries and related issues. Dental plaque is the colonization ofmicroorganisms noticed on a tooth surface as a biofilm,implanted in a matrix of polymers of host andbacterial origin. Many researchers have discussed plaque as the soft,firm material found on the tooth surfaces, whichis not easily removable on rinsing with water.[18,19] Periodontal disease is one of the diseases that affectthe hard and soft tissues nearby teeth. Gingivitis, isconsidered as initial stage of periodontal disease. Gingivitis is usuallyoccurringbecause ofinadequate oral hygiene. Gingivitis is characterizedby inflammation, redness, and bleeding on probing. Patients would be reasonably very disappointed with their orthodontic treatment if at the completion of their treatment, teeth are permanentlymarked and they have gingival disease. The most extensive mechanicalway of household plaque control is tooth brushing.There areample studies that show that bytooth brushing and other mechanical cleansingprocedures, plaque and gingivitis might be restricted mostconsistently.[2,12,20]

CONCLUSION

Within the limitations of the study, authors concluded very striking inferences. They stated that all three brushing systems were effective in plaque control and maintaining gingival health. Authors clearly noticed that both plaque index and gingival indexes were declining very sharply with continuous brushing. However, Colgate Slim Soft Ortho Toothbrush was identified as most efficient amongst all three tested systems for reducing plaque and maintaining optimal gingival health in orthodontic patients. Our study outcomes must be taken as suggestive while applying clinically. Nevertheless, authors expect few other authentic studies to be conducted with wider parameters.

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