

Periodontal Conditions Associated with Space Maintainers Following Two Different Dental Health Education Techniques

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The aim was to investigate the effect of fixed and removable space maintainers on periodontal status of children and to compare the efficiency of verbal and written dental health education. 52 healthy children aged between 7-10 years who will be treated with fixed or removable appliances were divided into two subgroups to whom were given verbal and written dental education. Plaque index, bleeding index and mean pocket depth scores of the teeth were recorded at baseline and 3, 6 and 9 months after application. Plaque, bleeding index and mean pocket depth scores showed significant difference in the appliance groups in the follow-ups. Plaque index scores displayed a positive correlation with the duration of both appliances. The difference between pocket depth scores were found to be significant in the follow-ups in both appliance groups while it was insignificant between education groups and significant increase in bleeding index scores was observed in both appliance groups and education techniques given. It is concluded that both removable and fixed space maintainers can result in inflammation on periodontal tissues of the children.

Key words: space maintainers, periodontal health, oral hygiene, periodontal index

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INTRODUCTION

The early loss of primary teeth may be the reason of malocclusion in permanent dentition. Therefore, removable and fixed orthodontic appliances are used to maintain the arch length and for the proper relationship between dental arches.¹⁻³

Local factors play an important role in plaque retention and development of gingivitis. It has been reported that fixed and removable orthodontic appliances, brackets and bands frequently cause gingival infection thereby complicate oral hygiene and cause inflammation, bleeding, gingival enlargement and increase in pocket depth.⁴⁻⁶ The main reasons are the increase in plaque accumulation caused by bands, brackets and arch wires which are more likely to be in contact with the gingival margin and mechanical or chemical irritation due to exposed cement. Also cleaning the teeth by toothbrush and dental floss is more difficult.⁷⁻⁸ However, it was also reported that orthodontic appliances don't necessarily cause irreversible alveolar bone tissue destruc-

tion.⁹⁻¹⁰

Since fixed space maintainers are generally expected to be a predisposing factor for dental plaque formation, it has been suggested that providing oral health education (OHE) for the children using orthodontic appliances as well as their parents are necessary for the elimination of dental plaque.¹⁰⁻¹² Numerous oral health education programs provided by the help of verbal, written and visual sources have been reported to improve the oral hygiene status of the child patients.¹¹⁻¹⁶ These programs exhibited varying degree of improvements in dental health behaviors.

The aim of the present study was to investigate the effect of removable and fixed space maintainers on periodontal tissues in 3, 6 and 9 month control periods and to compare the effect of verbal and written oral health education on improving dental hygiene on children.

MATERIALS AND METHOD

56 children (thirty-two girls and twenty-four boys) between the ages 7-10 (mean age 8.2) participated in this study. 4 children were excluded since they did not attend their appointments. A written consent was taken from the parents of the children. The selection criteria for the study were; 1) need for space maintenance treatment due to early loss of primary molars 2) absence of periodontal disease 3) absence of mental handicap 4) absence of physical handicap that limits free movement of hands 5) belonging to the same socio-economic background and high caries risk groups 6) absence of systemic disease 7) not using regular medicine 8) absence of TMJ problem or bruxism 9) absence of abnormal breathing and oral habits 10) being able to attend follow-up controls 11) not used antibiotics in the last 3 months and plaque inhibiting agents during the previous 6 months.

Clinical evaluation was performed both intraorally and radio-

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Table 1: The distribution of orthodontic appliances.

Type of appliance	Maxilla	Mandibula
Removable (n=26)	9 (35%)	17 (65%)
Fixed (n=26)	8 (31%)	18 (69%)

logically with regard to indication of space maintainer. Children were separated into fixed (Group I, n=26) and removable (Group II, n=26) appliance groups. Fixed appliances were made up of band and loop, whereas removable space appliances were constructed with a vestibule arch and adams crochets. Fixed space maintainers were cemented by a glass-ionomer cement releasing fluoride (Rely X, 3M ESPE, St Paul, MN, USA).

The distribution of appliances according to the jaws is presented in Table 1. Total of 33 and 60 primary teeth were missing on maxilla and mandibula respectively and the distribution of the teeth were; 9 maxillary first molars, 24 maxillary second molars, 12 mandibular first molars, 48 mandibular second molars.

Children in both group (I and group II) were divided into two subgroups that were given verbal (Group V, n=26) and written oral health education (Group W, n=26). Group V received verbal oral health education (OHE) individually, whereas in group W only (written) texts were given that included the same information as in the group V. Parents accompanied children in both groups. Verbal oral health education was given in a single session with one by one communication comprising topics such as plaque formation, proper brushing techniques, the importance of the teeth, the etiology and prevention of dental caries and periodontal diseases.

Before placing appliances and giving OHE, a form which included close-ended questions about nutrition, tooth brushing habits, the frequency of dental visits as well as the level of income and education of the family was filled in.

One week before the application of appliances, plaque and bleeding index scores and the pocket depths of the teeth were measured. In the fixed appliance group, indices were recorded

One week before the application of appliances, plaque and bleeding index scores and the pocket depths of the teeth were measured. In the fixed appliance group, indices were recorded from teeth that bands would be applied (Group T= test teeth) and the opposing teeth (Group C=control teeth) whereas for removable appliances, teeth which crochets would rest on (test teeth) and the antagonist teeth (control). All the scores were obtained

from the mesial-vestibule mid-vestibule, distal-vestibule distal-palatinal, mid-palatinal and mesial-palatinal sides of the both test and control teeth in each patient with a periodontal probe of tip diameter 0.5 mm. For each patient the mean values were calculated and used in statistical analysis. All periodontal indexes were obtained by the same periodontist.

Modified gingival index (Lobone) was used for bleeding index and if bleeding occurred in 15 seconds following probing of test and control teeth it was determined as 1 and if no bleeding occurred it was determined as 0. The plaque index scores were obtained by examination of all the teeth in the mouth (test and control) according to Loe&Silness¹⁷ and evaluated by Turesky.¹⁸ In group “V”, children were asked to bring their tooth brushes and tooth paste on the day the appliances were placed. Oral hygiene instructions were given to remove the plaque effectively on models with active involvement of the participants.

After space maintainers were applied all periodontal examinations were repeated in one week, 3, 6 and 9 months periods. Baseline scores covered the mean of initial and one week scores. Intraexaminer consistency for periodontal evaluation at baseline and 3, 6, 9 months control periods were performed using Kappa analysis with a minimum level 85% confidency. In the control sessions the development of new caries and the retention of the appliance were evaluated by two clinicians.

Data about the test and the control teeth with fixed and removable space maintainers in the three control periods as well as the difference between the education groups were statistically evaluated. Comparisons of plaque index, bleeding index scores and pocket depths in the groups were evaluated according to two-way variance analysis ANOVA in SPSS program, Pearson Chi-Square test and Fisher’s Exact test.

RESULTS

1) Evaluation of Plaque Index Scores

Means of plaque index scores in both appliance groups at baseline and in the three control periods are presented in Table 2.

At baseline the difference between the plaque index scores of fixed and removable appliance groups was found to be statistically non significant using two-way ANOVA variance analysis (p>.05), while the difference was significant in the three months control

Table 2: Plaque index scores (Turesky) of both appliance and education groups at baseline and three control periods (mean+standard deviation).

	Removable Appliances		Fixed Appliances	
	Verbal (n=13)	Written (n=13)	Verbal (n=12)	Written (n=14)
Baseline	2.49±0.60	2.55±0.51	2.43±0.33	2.47±0.92
3 months	2.37±0.64	2.49±0.42	2.02±0.63	2.29±0.74
6 months	2.23±0.55	2.52±0.39	1.99±0.56	2.51±.770
9 months	2.19±0.54	2.47±0.37	1.99±0.55	2.44±0.75

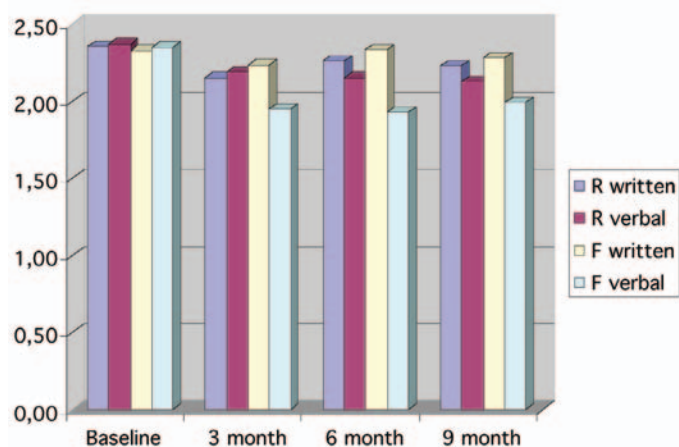


Figure 1: Plaque scores according to Turesky plaque index (R: Removable, F: Fixed)

period ($p < 0.05$) The difference was non significant at baseline and in 3 months period in both education groups ($p > 0.05$). In 6 and 9 months control periods the difference in plaque index scores was non significant in both appliance groups ($p > 0.05$) while the difference between the education groups was significant ($p < 0.05$) (Figure 1).

2) Evaluation of Modified Bleeding Index Scores

Mean of modified bleeding index scores of test and control teeth at baseline and in the three control periods is presented in Table 3.

The difference in bleeding index scores was statistically non significant in test teeth of two appliance groups at baseline as well as in education groups according to Pearson Chi-Square test ($p > 0.05$). However, the difference between the two appliance groups was statistically significant at 3 months ($p < 0.05$), while the difference between the two education groups were statistically non significant ($p > 0.05$). In the control periods of 6

Table 3: Mean (%) of bleeding index scores of both test teeth (T) and control teeth (C) at baseline and in three control periods.

	Removable Appliance				Fixed Appliance			
	Verbal(n=13)		Written(n=13)		Verbal(n=12)		Written(n=14)	
	T	C	T	C	T	C	T	C
Baseline	0.46	0.15	0.54	0.23	0.33	0.42	0.42	0.43
3 months	0.31	0.31	0.31	0.31	0.50	0.50	0.78	0.71
6 months	0.31	0.31	0.46	0.31	0.92	0.67	0.93	0.50
9 months	0.31	0.38	0.46	0.31	0.92	0.58	0.93	0.50

and 9 months, the differences between the appliance groups and also between the education groups was statistically significant ($p < 0.05$).

The difference in bleeding index scores in control teeth of removable appliance group was statistically significant between education groups at baseline ($p < 0.05$), while the difference were non significant in the control periods of 3, 6 and 9 months ($p > 0.05$). In fixed appliance group the bleeding index scores for control teeth were found to be statistically non significant between education groups in the baseline and in the 3 months ($p > 0.05$), whereas the difference was significant in the 6 and 9 months according to Fisher’s Exact Test ($p < 0.05$). (Table 3) and (Figure 2).

3) Evaluation of Pocket Depth Scores

Mean pocket depth scores of test and control teeth in both fixed and removable appliance groups in baseline and 3, 6 and 9 months periods are presented in Table 4.

The difference in pocket depth scores was found to be statistically significant in both group I and II in all the control periods (3, 6, 9 months) in both test and control teeth compared to baseline, while the difference was non significant between the education groups ($p > 0.05$).

The difference in pocket depth scores in test and control teeth in group II (removable appliances) in 3, 6, and 9 months compared to baseline scores were found to be statistically significant and the difference between the education groups was non significant ($p > 0.05$), whereas in group I (fixed appliance) the difference in pocket depth scores in 6 and 9 months evaluation periods was found to be significant ($p < 0.05$). The difference in group I was insignificant between education groups ($p > 0.05$). Mean periodontal pocket depth scores of the groups are shown in Figure 3.

DISCUSSION

In the present study, fixed and removable space maintainers and the role of verbal or written oral-health education (OHE) on the periodontal status of the children among 7-10 years of age were investigated. In both appliance groups significant differences were observed between plaque, bleeding indexes and pocket depth scores during the control periods of 3, 6 and 9 months.

A significant increase was detected between the baseline and 3 months follow up period for plaque index while there was no significant difference in 6 and 9 months with regard to two appliance groups. Plaque index scores displayed an increase in written OHE group compared with verbal in all the follow up periods. The plaque index scores of both verbal

and written OHE groups exhibited significant increase in 6 and 9 months periods while it was not significant in 3 months. Thus, plaque accumulation was found to be lower in the verbal OHE group compared with the written in 6 and 9 months.

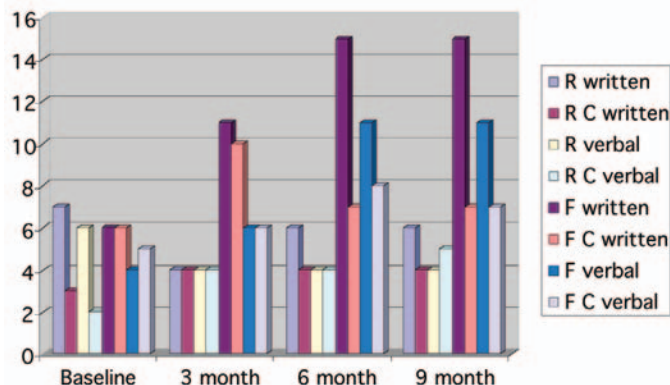


Figure 2: Bleeding index scores of appliance groups (Group I,II) at baseline and control periods. (R: Removable, Fixed: F, C: Control)

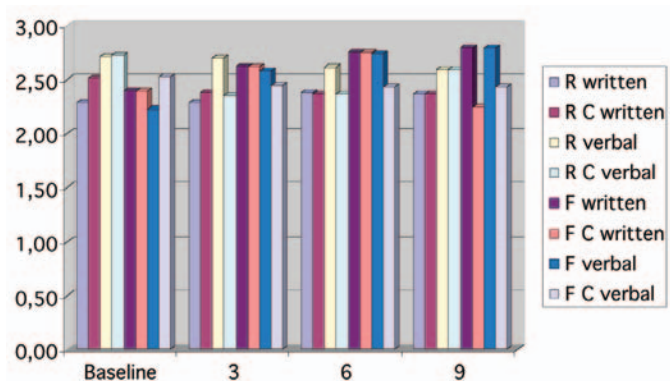


Figure 3: Pocket depth scores of teeth in group I and II (R: removable, F: fixed, C: Control)

It is reported that fixed space maintainers, accompanied with an increase in the amount of plaque, cause an increase in concentration of carbohydrates and the numbers of bacteria in each milligram (mg) of plaque.¹⁹ Schei and Arneberg.²⁰ have studied the effects of bands that are used in fixed orthodontic appliances on dental plaque accumulation and reported that the number of *S. mutans* increased in most of the patients. In this study, the increase in pocket depth and bleeding during probing, due to an increase in the amount of plaque observed in the fixed appliance group, is in accordance with the findings mentioned by Boyd *et al.*⁷ in which removable appliance group showed less plaque formation. In their study on adolescents and adults who received fixed orthodontic appliance treatment, they reported that gingivitis developed significantly in adolescents, whereas less inflammation was found in adult patients who can remove plaque over the surface more efficiently.

When OHE and pocket depth was considered during the follow up periods, a significant increase was observed only in fixed appliance group and no significant difference for verbal and written OHE was found at the end of the evaluation period (9 months). Attack *et al.*¹⁰ demonstrated that pocket depth increases during orthodontic treatment but no attachment loss occurs during this period. They have also reported that motivation of the orthodontic patient about oral hygiene is of great importance. In addition Dubey *et al.*¹¹ reported that orthodontic appliances have no effect on oral hygiene and periodontal health when an appropriate dental health education is provided.

It was not possible to compare the results of our study with other experiments, since the documents about the effect of space maintainers on the periodontal tissues of children is lacking and studies are mostly performed on children receiving orthodontic treatment. It is demonstrated that orthodontic treatment effects periodontal health and causes an increase in plaque accumulation, and in the number of bacteria in supra and subgingival flora. Decalcification in some parts of enamel is also reported after orthodontic treatment because of accumulation of bacterial plaque.^{21,22} Therefore it is important to determine the specific ar-

Table 4: Periodontal pocket depth scores of test and control teeth in oral health education groups.

Pocket depth	TEST TEETH				CONTROL TEETH			
	Group I		Group II		Group I		Group II	
	Verbal	Written	Verbal	Written	Verbal	Written	Verbal	Written
Baseline	2.71±0.56	2.29±0.34	2.23±0.65	1.75±0.61	2.73±0.49	2.52±0.45	2.53±0.72	2.59±0.33
3 months	2.70±0.42	2.29±0.34	2.58±0.78	2.00±0.64	2.35±0.70	2.38±0.52	2.45±0.71	2.75±0.45
6 months	2.62±0.37	2.38±0.39	2.74±0.75	2.79±0.61	2.37±0.38	2.37±0.47	2.43±0.68	2.71±0.49
9 months	2.60±0.36	2.37±0.35	2.73±0.73	2.25±0.59	2.37±0.38	2.37±0.47	2.45±0.70	2.73±0.51

eas in which periodontal diseases can alleviate, and provide relevant treatment alternatives and chose an oral hygiene program.

Lees *et al.*¹² compared oral hygiene education programs using verbal, written and video materials and found that oral education was more efficient for gingival and plaque index than education performed with video or written, but no significant difference was found among the three education methods.

Glavind *et al.*¹³ found no significant difference for plaque and bleeding indices in patients suffering from periodontal diseases who received OHE either given oral or additionally by TV. Various OHE programs have been evaluated and it is reported that audiovisual presentations appeared to be better than verbal or written OHE. In this study although a significant difference in plaque and bleeding indexes was found during 6 and 9 months follow-up periods between verbal and written OHE groups, and verbal OHE was more effective compared to written, more effective OHE programs are necessary since sufficient improvement can not be observed at the end of follow up periods, when compared to baseline. Therefore different and attractive motivation methods including audiovisual programs should be developed in order to help children gain good oral hygiene and tooth brushing habits. Parents having regular tooth brushing habits can set a good example and motivate their children's oral hygiene habits. In this study the attitude of children with regard to oral hygiene was not found parallel to their level of knowledge.

Eden *et al.*¹⁴ using three different audio-visual materials (acetates, slides, data-show) in a school-based prevention program, found that 7 days after the education remembering optitude decreased 67.8% and concluded that in order to retain the knowledge overtime, education programs should be repeated periodically to provide improvement in oral hygiene habits. This may be performed by the parents at home and teachers in the classroom once in a month to remind the children.

Plaque control was considered insufficient in the study and both education methods did not lead to significant improvement in the children's oral hygiene. Thus *Uncel et al.*²³ who reported that children's tooth brushing practice under the age of 10 is not effective because of their inefficiency of manipulation and lack of motivation showed similarity with our findings.

World Health Organization reported that training children of 7-9 age group about oral hygiene methods is more important and effective for preventive practices than in the other age groups.²⁴

Generally, children tend to brush teeth which are easily accessible. Mostly, anterior teeth and buccal surfaces were found to be brushed more efficiently. It has been reported that the lingual surfaces of maxillary and mandibular teeth are not brushed properly causing rapid plaque accumulation.²⁵ In the present study accumulation of plaque was observed to be more over lingual/palatinal surfaces of molar teeth and this finding is in accordance with other authors.

In conclusion; it is observed that both fixed and removable space maintainers cause an increase in plaque accumulation and unfavorable oral hygiene. Therefore OHE supported by supplementary materials (brochure, paintings etc.) for both children and parents are strongly emphasized. Special concern should be given on oral and dental health of children who use fixed space maintainers since they were found to cause an increase in bleeding index and pocket depth compared to the removable appliances.

Although verbal oral health education was more effective on the oral hygiene habits of the children than written OHE education both techniques were insufficient to improve oral hygiene therefore active involvement of parents should be encouraged.

Future studies with new educational techniques on impairment of oral health status related with fixed and removable space maintainers are needed.

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