

ORIGINAL RESEARCH



Oral Hygiene and Dietary Habits in Adolescents with Fixed Orthodontic Appliances: A Cross-sectional Study

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ABSTRACT

Objectives: Fixed orthodontic appliances (FOAs) may cause a temporary deterioration of oral hygiene with corresponding gingival inflammatory changes. Optimal oral hygiene and dietary changes are essential in order to avoid periodontal inflammation. The present study investigates to what extent the recommendations made by the orthodontist are followed by young patients.

Materials and methods: A total of 67 adolescent patients with FOA were examined and interviewed. The control group consisted of 70 patients of the same age who had not undergone any orthodontic treatment. A specific questionnaire (assessing dietary habits, oral hygiene measures) was used and comprehensive oral findings along with oral hygiene status were evaluated.

Results: The analysis of the data showed that despite intensive oral hygiene and dietary advice in the patients with FOA, there was no change in diet or oral hygiene habits. There were significantly higher signs of gingival inflammation and amount of dental plaque in FOA patients. Nutritional recommendations and oral hygiene measures for young people with FOA were not adequately enforced.

Conclusion: The findings indicate that frequent recalls should be scheduled with repeated reinforcement of oral hygiene and dietary modifications in FOA patients.

Keywords: Dietary habits, Fixed orthodontic appliance, Oral hygiene measures, Questionnaire.

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INTRODUCTION

In recent decades, orthodontic treatment for both European children and adults has considerably increased. Krey and Hirsch¹ reported an average of 15 to 63% of orthodontic treatment in European countries with Germany in a leading position. However, fixed orthodontic appliances (FOAs) may cause oral health problems due to difficulty in maintaining oral hygiene.² It has been observed that in several patients, multiband or multibracket appliances result in development of marginal gingivitis and or gingival hyperplasia.³⁻⁸ These changes are primarily attributed to increased plaque accumulation,⁹⁻¹³ as FOAs increase the difficulty in maintaining oral hygiene and behave as niches for plaque retention.^{7,14}

In addition to irritation of the periodontal tissues from FOA, there is an increased risk of decalcification of the tooth structure that is caused by the prolonged adhesion of food debris and increased plaque accumulation.^{2,15-17} Furthermore, fixed orthodontic treatments also lead to shifts in the salivary pH.¹⁸

It is also established that regular oral hygiene is essential to avoid inflammatory changes, deterioration of the periodontal condition, and demineralization of enamel surfaces during orthodontic treatment.¹⁹⁻²¹ Proper brushing technique, a "tooth-healthy" diet, and frequent follow-up appointments are thus crucial for long-term success of orthodontic therapy.²² However, the modification of existing dietary and oral hygiene habits is not easy to achieve and requires a special effort on the part of the dentist as well as the patient. Patient motivation

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and compliance is essential to achieve satisfactory results. Use of mouthwashes, such as chlorhexidine in addition to regular oral hygiene measures can effectively reduce plaque and gingivitis.²³

The aim of the present study was to examine to what extent the recommendations and instructions given by the orthodontist for maintaining the health of the oral cavity in terms of diet and oral hygiene measures are actually considered and implemented by patients during FOA therapy.

MATERIAL AND METHODS

Inclusion of Patients

A total of 184 consecutive patients were screened for this cross-sectional study. One hundred thirty-seven patients met the inclusion criteria (67 patients in the FOA group, 70 patients in the Control group) and were enrolled. All patients came from the Rhineland-Palatinate area and were treated in the University Medical Center of the University of Mainz. Patients with severe general or systemic diseases and patients on long-term medication were excluded from the study.

FOA Group

Sixty-seven outpatients (30 females and 37 males) aged 12 to 18 years (mean: 14.3 ± 1.8 years) were treated exclusively with FOA (multiband and/or bracket appliances). Each FOA patient was informed and instructed about the need for intensive oral hygiene measures before starting treatment by the attending orthodontist. This instruction included the demonstration of an appropriate brushing technique and instruction for use of adequate oral hygiene aids (e.g., interdental floss, mouth rinses). A change in diet was also proposed when required.

These recommendations were given for the entire period of FOA treatment. A questionnaire was created separately for the study to investigate and monitor the compliance with oral hygiene and the control of eating habits of the patient with the parent/caregiver during an inspection appointment and filled accordingly. After a minimum of at least 12 months from the start of FOA treatment (average of 16 months \pm 4 SD), all patients were questioned about their overall well-being, whether they would be willing to undergo the same treatment again, oral hygiene habits, food choices, and the frequency and method of tooth brushing.

Control Group

The control group comprised of 70 adolescent patients of the same age group (34 girls and 36 boys, mean age: 15.1 ± 1.7 years SD) without FOA treatment, who also

fulfilled the exclusion criteria and who visited the dental clinic as part of monitoring and follow-up appointments. In these subjects, the same questionnaire for recording the oral hygiene and dietary habits was used and there was a thorough dental examination that was performed by the same dentist always.

Clinical Examination

One calibrated examiner performed all oral examinations. In all patients, an assessment of caries frequency (DMFT-value by Klein²⁴) was done by probing after thorough cleaning of the tooth surfaces. Evaluation of DMFT was not accurately possible in all areas for the FOA patients due to the presence of brackets and bands. Radiological examination (panoramic radiographs), the detection of approximal plaque (API according Lange et al²⁵), and an assessment of the degree of inflammation of the gingiva (SBI by Lange et al²⁵) were done for all patients. Furthermore, it was also recorded to what extent the patients undergoing FOA treatment had followed the oral hygiene and dietary guidelines recommended to them prior to treatment.

Statistical Analysis

The statistical analysis was performed using the statistical program Statistical Package of the Social Sciences (SPSS) version 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were calculated for all used variables, including absolute and relative frequencies for categorical scaled data, and details of averages, standard deviations, median values, quartiles, and minimum and maximum values for continuous data. The target variables were evaluated using the Mann-Whitney test. Bonferroni correction with a local significance level of $\alpha = 0.016$ was used to account for multiple testing; p-values < 0.016 were considered statistically significant. Relationships between categorical variables were analyzed by chi-square test or Fisher's exact test extended. The p values presented are to be regarded as descriptive.

RESULTS

The frequency of dental check-up appointments was comparable in both groups. A minority in both groups (6.15% of FOA group and 8.41% of control group) visited each quarter a dentist. However, the FOA patients visited the dentist more often every 6 months (73.9% of the FOA group compared with 57.0% of the control group). The motivating factors for dental check-up appointments were comparable in both groups and there were no significant differences.

All participants were interviewed regarding their oral hygiene habits. The indications for use of the respective

Table 1: Oral hygiene measures of fixed orthodontic appliances group and the control group

	Frequency of toothbrushing (%)		Use of mouthrinse (%)		Use of interdental brushes (%)		Use of dental floss (%)	
	FOA group	Control group	FOA group	Control group	FOA group	Control group	FOA group	Control group
	0x/day	1.5	0.0	56.0	67.3	39.4	80.9	73.1
1x/day	10.5	14.7	33.3	29.1	21.2	11.8	19.4	39.1
2x/day	50.8	61.5	9.1	3.6	24.2	7.3	6.0	5.5
>2x/day	37.3	23.9	1.5	0.0	15.2	0.0	1.5	1.8
p-value	0.117		0.164		<0.001		0.045	

Values represent descriptive means and Standard deviations

Table 2: Evaluation of dietary habits in relation to sugar-containing food

	Consumption of sweets (%)		Consumption of candy (%)		Consumption of chocolate (%)	
	FOA group	Control group	FOA group	Control group	FOA group	Control group
0x/day	3.0	2.7	37.3	27.3	10.5	10.0
1x/day	31.3	31.8	40.3	40.0	52.2	52.7
2x/day	40.3	40.0	19.4	21.8	31.3	26.4
>2x/day	25.4	25.5	3.0	10.9	6.0	10.9
p-value	1.000		0.189		0.682	

Values represent descriptive means and Standard deviations

Table 3: Eating and drinking habits of fixed orthodontic appliances group and control group

	Consumption of water		Consumption of milk		Consumption of Cola-containing drinks		Consumption of sparkling water-containing drinks		Consumption of fruit juice		Consumption of coffee/tee with sugar		Consumption of fruits	
	FOA group	Control group	FOA group	Control group	FOA group	Control group	FOA group	Control group	FOA group	Control group	FOA group	Control group	FOA group	Control group
	0x/day	7.5	3.6	28.4	23.6	46.3	28.2	25.4	14.6	19.4	16.4	56.7	40.0	10.5
1x/day	7.5	12.7	32.8	28.2	37.3	45.5	16.4	22.4	20.9	30.9	17.9	26.4	19.4	20.0
2x/day	11.9	19.1	28.4	40.9	10.5	16.4	16.4	27.3	29.9	28.2	17.9	25.5	47.8	33.6
>2x/day	73.1	64.5	10.4	7.3	6.0	10.0	41.8	35.5	29.9	24.6	7.5	8.2	22.4	41.8
p-value	0.251		0.395		0.095		0.112		0.524		0.181		0.029	

Values represent descriptive means and standard deviations

oral hygiene aids are listed in Table 1. The majority of the control subjects (79%) opined that they did not have to brush teeth after meals. Almost half of the FOA patients, on the contrary (45.5%), reported that they had to clean after each meal (p=0.001). The evaluation of the eating habits of both groups showed that no significant differences were present with respect to the consumption patterns (Table 2). All persons participating in the study were asked about preference for sweets and other refined snacks. Table 3 summarizes that no significant differences in consumption patterns of both groups of patients were observed.

A large number of FOA patient group (46.0%) noted several problems, such as bleeding gums, redness of the gingiva, or hyperplasia. The majority of the FOA patient group (65.7%) stated that they must brush more than usual in order to achieve an adequate oral hygiene ever since they began orthodontic treatment, due to the presence of fixed appliances. Table 4 summarizes the results of the DMFT-values, the API values, and the SBI

Table 4: Approximately plaque index, sulcus bleeding index, and decay-missing-filled teeth values of the functioning outer aspect group and the control group

	FOA group	Control group	p-value
DMFT-value	2.32±1.53	1.51±1.22	≤0.001
API (%)	40.76±7.89	21.20±6.20	≤0.001
SBI (%)	30.31±12.16	17.62±9.65	≤0.001

Values represent descriptive means and standard deviations

values. The results indicate the oral hygiene problems of FOA patients. Oral hygiene and amount of dental plaque were evaluated, analyzing API. The amount of dental plaque and caries frequency were significantly higher in the FOA group (p≤0.001). Furthermore, gingival bleeding was significantly higher in the FOA group measured by SBI (p≤0.001).

A high proportion of the FOA patients (70.2%) stated that since they began with the orthodontic treatment, they urgently required the use of additional aids (interdental brushes, oral irrigator) to perform adequate oral hygiene.

DISCUSSION

In the present study, two groups of patients were evaluated in relation to the awareness to oral hygiene and the dietary patterns. The comparative study between these two groups of patients was performed to evaluate the practice of oral hygiene and dietary habits of these groups. Patients with FOA require intensive oral hygiene measures and special nutritional intervention to avoid a deterioration of the periodontal condition.¹⁹⁻²¹ In the FOA patients, plaque retention sites are increased and more difficult to maintain; hence, brushing after each meal and the use of interdental brushes becomes very important. Inadequate oral hygiene usually leads to gingivitis and can progress to periodontitis.³⁻⁸ In the present study, the amount of dental plaque and gingival bleeding was significantly higher in the FOA group, which confirms the finding of the previous studies.

The grooming of children and adolescents with FOA should therefore be monitored throughout the treatment period and frequent recall appointments should be scheduled for evaluating oral hygiene and to see if nutritional recommendations are adhered to. Witt²⁶ proposed specific recommendations for stringent oral hygiene during orthodontic treatment. In the present study, the extent to which instructions from the orthodontist with regard to oral hygiene measures and food choices were followed was of particular interest. In the present study, the FOA patients had significantly better oral care than the control group, following the care instructions given to them. Mouthwashes were used daily by nearly half of the patients (45%) and by 33% of the control patients. The positive effect of the additional use of mouthwashes, such as Chlorhexidin®, meridol®, or plant extracts has already been proven in many studies.^{12,13,23,27,28} In patients with difficulties in performing mechanical teeth cleaning, additional chemical plaque control is often useful and effective.²⁹

No significant difference was observed, however, in relation to the eating habits in both groups of patients. In this study, it was of interest particularly if the treatment group had reduced/avoided sugary snacks and acidic drinks following the instructions given to them prior to orthodontic treatment. However, about 90% of the patients in both groups mentioned that they consume chocolate daily and more than 97% of patients in both groups declared that they consume sweets at frequent intervals on a regular basis. These findings are consistent with numerous reports, which state that eating habits are rarely modified.³⁰ Einwag and Gallitz³¹ have already demonstrated that children satisfy a large part of their energy needs through the consumption of sweetened snacks. Daily consumption of sweets was stated by about

60% of both groups of patients. Also of importance is the selection of drinks for fulfilling the fluid requirement. From a dental perspective, primarily water or unsweetened drinks are recommended. Fruit juices and soft drinks often contain fruit acids and sucrose and should not be used as a regular drink due to the acidic pH.³² More than half of the adolescent patients in both groups, however, indicated that they consume various soft drinks on a daily basis. It was expected that those with fixed appliances failed to keep the nutritional recommendations and the difficulty in performing oral hygiene promoted plaque accumulation. Lara-Carrillo et al³³ showed that in patients with FOA, there is deterioration of oral hygiene situation. The authors were able to demonstrate a reduction in the pH-value and the buffering capacity of saliva and hence increased risk of tooth decay in young patients with FOA treatment. Because of this special situation, individual prophylactic measures should be performed with frequent recall appointments in patients with fixed appliances to check the compliance and on the contrary to carry out early action to prevent possible demineralization of tooth structure.³⁴

CONCLUSION

The analysis of the survey indicates that despite education regarding oral hygiene practices and dietary recommendations by the orthodontist, adolescent patients do not consider the suggestions and continue with their usual patterns of food intake during FOA treatment.

This suggests that strict instructions with regard to oral hygiene practices and dietary modifications should still be given at the beginning of FOA treatment and reinforced during every recall visit. Recall appointments should be made at short intervals in order to ensure close monitoring of patients to identify potential periodontal inflammation or tooth structure defects at an early stage and to strengthen compliance of the young patients.

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