

ORAL HYGIENE EVALUATION IN ORTHODONTIC PRACTICE

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ABSTRACT

This study was performed to evaluate oral hygiene during orthodontic treatment. 140 patient (75 females and 65 Males) were selected from Marmara University, Department of orthodontics, undergoing active orthodontic treatment with segmental or full arch appliances under the following phases, i.e., leveling, canine retraction, consolidation and last stage. The patients were divided into 3 major age groups; 13-16 years, 17-20 years and 21-24 years, respectively. In the 1st group the male female ratio was 21:20, 2nd group ratio was 22:27, and the 3rd group ratio was 22:20. The patients were provided with a questionnaire concerning diet intake, general brushing habits, frequency of brushing and oral hygiene procedures. The gingival index, frequency distribution, bleeding index, ortho-plaque index, periodontal pocket depth and periodontal pocket depth frequency distribution was calculated for each patient. The results showed that both the sexes practiced good oral hygiene procedures. However, females showed more oral hygiene awareness as compared to their male counterparts. Gingival index values presented mild to moderate inflammation. Frequency distribution presented that half of the patients were showing bad gingival conditions.

The periodontal pocket depth values were in normal range, but when considering deep pockets, their percentage exhibited that half of the sites had deeper pockets. Plaque index showed fair or average oral hygiene. It was concluded that oral hygiene procedures have a mild to insignificant effect during active orthodontic treatment.

Keywords: *Bleeding index, periodontal pocket depth, gingival index, ortho-plaque index, Periodontal pocket depth frequency distribution, Gingival index frequency distribution.*

INTRODUCTION

The maintenance of oral hygiene during orthodontic treatment is an essential part of orthodontic therapy. The gingival and periodontal health status of young patients undergoing fixed appliance therapy has to be monitored during orthodontic tooth movement as it may initiate gingivitis or cause periodontal attachment loss. The plaque-retentive nature of fixed orthodontic appliances aids in the plaque accumulation at the gingival margin and therefore may contribute to the incidence and severity of gingival inflammation.

Bands, brackets, arch wires and other devices allow plaque accumulation. Plaque accumulates particularly beneath bands from which orthodontic band

cement has been washed out, and on interfaces between composite and enamel¹. Plaque is found predominantly cervical to brackets and under archwires. Beneath such plaque, superficial enamel may quickly be demineralized² consequently white spot lesions maybe observed at these plaque retention sites³. In general, the oral hygiene worsens during orthodontic treatment leading to gingival and periodontal complications^{4,5}. There is clear evidence that cessation of all oral hygiene during orthodontic treatment allows plaque accumulation and initiates gingival inflammations. The development of gingival inflammation in orthodontic patients is associated with specific bacterial types that rapidly colonize the tooth surface when plaque is left undisturbed. Local factors may play a role in the retention of plaque and the development of

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gingivitis, such as irregularly aligned faulty restorations fixed crowns⁹ removable prosthetic or orthodontic appliances^o and orthodontic bands" which are often associated with gingival inflammation.

It is therefore logical to ensure good gingival and periodontal health before the commencement of orthodontic treatment. Progression of some gingivitis lesions to periodontitis results in the irreversible loss of tooth supporting tissues, which further complicates orthodontic treatment.

Although it might be reasonable to suppose that orthodontic malocclusions and lack of oral hygiene procedures leads to gingival complications and plaque accumulation, these associations have not been established by research 4,5.

Therefore, our aim was to evaluate the oral hygiene conditions during orthodontic treatment therapy in teens and adolescent patients aged between 13 to 22 yrs, and to determine the amount of oral hygiene care followed by the patients during treatment.

MATERIALS AND METHODS

The 140 patients were selected with no medical and systemic contraindications from Marmara University, Department of orthodontics, undergoing active orthodontic treatment with segmental or full arch appliances under the following phases i.e., leveling, canine retraction, consolidation and last stage. The patients were divided into 3 major age groups; 13-16 years, 17-20 years and 21-24 years, respectively. In the 1st group the male female ratio was 21:20, 2nd group ratio was 22:27, and the 3rd group, ratio was 22:20. The gingival index, bleeding index, ortho-plaque index and the periodontal pocket depth was calculated for each patient. The bleeding index and gingival index are universally used as reliable clinical indicators of gingival inflammation. The stage of orthodontic treatment and the type of fixed appliance treatment was recorded. SPSS statistics computer program was used to record the patient data.

Gingival Index (GI): Each tooth was probed on 3 sites buccally and one side lingually. Buccally the gingival was checked mesio-buccally, disto-buccally and in the center of the buccal surface, by means of a Michigan periodontal probe with graduations of 1.0 mm.

Bleeding Index (BI): The bleeding index values were also recorded. The Ainamo's Method²¹ was used in which the sulcus was probed carefully on the facial

and lingual surfaces with a periodontal probe. Probing begins on the facial surface, proceeding from the distal to the mesial surface, then on the lingual surface from the distal to the mesial.

Ortho plaque Index (OPI): Cottons tips or applicators were saturated with MIRA-2-TON dental plaque indicating solution and painted on the teeth. Plaque was scored on the basis of the presence or absence of plaque on each tooth. Old plaque turns violet and new plaque turns red on application of the solution. The points of measurement for this index are the cervical, mesial or distal and coronal to the bracket.

Periodontal Pocket Depth (PPD): The periodontal pocket depth of each tooth was measured mesiobuccally, distobuccally, and on the center of the buccal and lingual surface. The pocket depth was taken as the distance between the free gingival margin and the bottom of the gingival sulcus. The mean pocket depth of each tooth was calculated.

RESULTS

According to Table 1, 12.3% of the male patients had segmental appliances while 87% had full arch mechanics. In the female patients 18.7% had segmental while 81% had full arch fixed appliances. Both sexes renewed toothbrush after 6 months (Table 2) while females toothbrush duration was more than males (Table 2, 1). According to tooth brushing technique (Table 3) both sexes brushed teeth only.

According to the diet intake of the patients (Table 4), 47% of the patients had sweets, followed by 27% with cold drinks, 22% with fruits and 3.6% with carbohydrates. When compared to the sexes, 56.9% of the male patients had sweets followed by 20% with fruits, 18.5% with cold drinks and 4.6% with carbohydrates. In the female group, 38.7% had sweets, 34.7% had cold drinks, 24% had fruits and 2.7% had carbohydrates.

There was no significant difference between BI values of males and females. In the diet groups, the highest value was of carbohydrates, followed by cold drinks and sweets. Brushing technique groups did not show any significance difference but the highest BI value was of flossing & brushing group (17.50%), followed by teeth and gums (14.52%).

Sweets and fruits showed a slightly increased mean GI value, but it is not significant. Flossing and brushing technique showed a slight increase in the mean GI value of 1.72. In the GI frequency distribu-

TABLE 1. RELATIONSHIP OF MALE AND FEMALE PATIENTS ENCOUNTERED WITH SEGMENTAL AND FULL ARCH ORTHODONTIC APPLIANCES

Sex	Measurements	Type of appliance		Total
		Segmental	Full arch	
Male	Count	8	57	65
	% within sex	12.3%	87.7%	100%
	% within type	36.4%	48.3%	46.4%
	% of total	5.7%	40.7%	46.4%
Female	Count	14	61	75
	% within sex	18.7%	81.3%	100%
	% within type	63.6%	51.7%	53.6%
	% of total	10%	43.6%	53.6%
Total	Count	22	118	140
	% within sex	15.7%	84.3%	100%
	% within type	100%	100%	100%
	% of total	15.7%	84.3%	100%

TABLE 2. RELATIONSHIP OF MALE AND FEMALE PATIENTS ACCORDING TO THE TREATMENT STAGE ENCOUNTERED

Sex	Measurements	Treatment stage				Total
		Leveling	Can. net	Consol	Last	
Male	Count	16	15	13	21	65
	% within sex	24.6%	23%	20%	32.3%	100%
	% within stage	47%	50%	42%	46.7%	46.4%
	% of total	11.4%	10.7%	9.3%	15%	46.4%
Female	Count	18	15	18	24	75
	% within sex	24%	20%	24%	32%	100%
	% within stage	53%	50%	58%	53.3%	53.6%
	% of total	13.9%	10.7%	12.9%	17.1%	53.6%
Total	Count	34	30	51	45	140
	% within sex	24.3%	21.4%	22.1%	32.1%	100%
	% within stage	100%	100%	100%	100%	100%
	% of total	24.3%	21.4%	22.1%	32.1%	100%

TABLE 3. RELATIONSHIP OF MALE AND FEMALE PATIENTS ACCORDING TO FREQUENCY OF RENEWAL OF TOOTHBRUSH DURING ORTHODONTIC TREATMENT

Sex	Measurements	Toothbrush renewal			Total
		6 months	One year	More	
Male	Count	30	31	4	65
	% within sex	46.2%	47.7%	6.2%	100%
	% within renewal	39.5%	52.5%	80%	46.4%
	% of total	21.4%	22.1%	2.9%	46.4%
Female	Count	46	28	1	75
	% within sex	61.3%	37.3%	1.3%	100%
	% within renewal	60.5%	47.5%	20%	53.6%
	% of total	32.9%	20%	0.7%	53.6%
Total	Count	76	59	5	140
	% within sex	54.3%	42.1%	3.6%	100%
	% within renewal	100%	100%	100%	100%
	% of total	54.3%	42.1%	3.6%	100%

Table 3.1. toothbrush duration and daily frequency

Sex	1 min	5 min	More
Male	18	32	15
Female	9	48	18
Brushing Frequency			
Sex	Once	Twice	Thrice
Male	20	33	12
Female	15	42	18

TABLE 4. RELATIONSHIP OF MALE AND FEMALE PATIENTS ACCORDING TO THE BRUSHING TECHNIQUE ENCOUNTERED DURING ORTHODONTIC TREATMENT

Sex	Measurements	Brushing technique			Total
		Teeth only	Teeth gums	Floss brush	
Male	Count	33	31	1	65
	% within sex	50.8%	47.7%	1.5%	100%
	% within technique	46.5%	47%	33.3%	46.4%
	% of total	23.6%	22%	0.7%	46.4%
Female	Count	38	35	2	75
	% within sex	50.7%	46.7%	2.7%	100
	% within technique	53.5%	53%	66.7%	53.6%
	% of total	27%	25%	1.4%	53.6%
Total	Count	71	66	3	140
	% within sex	50.7%	47%	2.1%	100
	% within technique	100%	100%	100%	100%
	% of total	50.7%	47%	100%	100%

TABLE 5. RELATIONSHIP OF MALE AND FEMALE PATIENTS ACCORDING TO DIET ENCOUNTERED DURING ORTHODONTIC TREATMENT

Sex	Measurements	Diet				Total
		Cold drinks	Sweets	Fruits	Carbohydrates	
Male	Count	12	37	13	3	65
	% within diet	18.5%	56.9%	20%	4.6%	100%
	% within stage	31.6%	56.1%	41.9%	60%	46.4%
	% of total	8.6%	26.4%	9.3%	2.1%	46.4%
Female	Count	26	29	18	2	75
	% within diet	34.7%	38.7%	24%	2.7%	100%
	% within stage	68.4%	43.9%	58%	40%	53.6%
	% of total	18.6%	20.7%	12.9%	1.4%	53.6%
Total	Count	38	66	31	5	140
	% within diet	27.1%	47.1%	22%	3.6%	100%
	% within stage	100%	100%	100%	100%	100%
	% of total	27.1%	47.1%	22%	3.6%	100%

tion values of male and female patients compared to the age code, The 18.5 age group had the highest GI FD value of 55.01, followed by 21.5 age group with 53.16. Sweets showed the highest GI FD value of 56.24, followed by cold drinks with 54.1. No significant difference is noted when compared to other diet groups.

In the brushing technique, the teeth and gums brushing showed an increased Mean GI FD value of 56.30, followed by teeth only technique with 52.03. When compared to the diet groups, the fruits group showed the highest mean PPD value of 1.73, followed by sweets with 1.66 respectively. Flossing and brushing showed the highest mean PPD value of 1.88 as compared to teeth only brushing technique with 1.65 and teeth and gums with 1.63.

As compared to the diet group, cold drinks, sweets and fruits showed a slight increase in the mean PPD FD values than the carbohydrates group. As observed, the teeth only brushing technique group showed 58.21 mean PPD FD value, followed by teeth and gums with 56.53 and floss and brush with 48.33.

In the OPI values of males and females, the biggest value was of 18.5 age group with a mean OPI value of 44.14, followed by 21.5 age group with a mean OPI value of 42.92.

When compared to the diet groups, sweets showed an increased mean OPI value of 42.97 followed by fruits with 42.15. As observed, the teeth and gums brushing technique showed a mean OPI index of 44.88 followed by teeth only brushing technique with 41.65.

DISCUSSION

Previous studies^{7,12,28} have not correlated patient oral hygiene habits with orthodontic treatment. The reason to evaluate the present study was to observe the levels oral hygiene procedures followed by the patients during orthodontic treatment, together with clinical examination of the oral hygiene status during orthodontic treatment.

Yeung et. al¹³ have investigated the periodontal and gingival status of orthodontic patients, yet none have correlated orthodontic treatment with sex, age period, toothbrushing techniques, diet etc which provides a general outlook regarding the oral hygiene procedures followed by male and female patients of various age groups during the course of active treatment.

Observations by Diamanti-Kipioti¹⁴ who in a longitudinal study found no significant variations in plaque, gingival and periodontal indices after initiation of orthodontic treatment. These results are in disagreement with other studies, which have found plaque retention associated with orthodontic treatment". Several authors have reported such increases in gingival inflammation by orthodontic appliances^{14,15}. However, these studies have failed to mention the oral hygiene procedures followed by the patients.

Zachrisson and Zachrisson⁵ reported that plaque index scores for their sample test decreased during the course of active treatment. Similar findings were reported by Alstad and Zachrisson¹⁶, in which a decline in plaque index, gingival index and bleeding index scores was observed for their test group after the initial placement of the orthodontic appliances.

In the present study the ortho-plaque index by Declerk and co-workers 1989¹⁷ was used, as it analyses the occurrence of plaque automatically, improves quantification of the colored tooth surface and reduces the subject deviation in the estimation of indices. Large portions of the buccal surfaces are covered by adhesive attachments in patient with fixed appliances. Regions cervical to the bracket base and those mesial and distal to the archwire are the most critical zones of plaque formation. It is, therefore, desirable to evaluate these zones separately for a plaque index.

In the study, additional to the gingival index and periodontal pocket depth parameters, the frequency distribution for gingival index and the periodontal pocket depth was calculated. This was done because in big groups the maximum and minimum mean values obtained might present a normal hygiene group, but after calculating the overall frequency distribution, we percentage the sites over the normal values to total sites of the mouth. Therefore, the percentage of the sites exhibiting periodontal problems and gingival index could be calculated.

During our present study, the oral hygiene procedures followed by the patients were recorded. It was found that 54% of the total patients renewed toothbrush in 6 months, followed by 42% after one year. It was however, observed that 61.3% female patients renewed their toothbrush compared to 46% of the male patients within 6 months. In the brushing duration, female patients brushed more as compared to their male counterparts. In the brushing frequency, females brushed twice and thrice daily more than the male patients.

The brushing technique was also evaluated in our study. As investigated, the majority of the patients followed the teeth only (50.7%) and the teeth and gums (47%) brushing technique, followed by 2.1% for the flossing and brushing technique. When compared to the sexes, 50.8% of the male patients brushed teeth only, followed by 47% with teeth and gums and 1.5% with flossing and brushing. In the female group, 50.7% brushed teeth only, followed by 46.7% with teeth and gums, and 2.7% with floss and brush. Oral hygiene steps during orthodontic treatment at short intervals are beneficial in eliminating plaque from uneven spots and scratches in the enamel not accessible to normal brushing techniques and prophylaxis pastes. A study by Alstad and Zachrisson 1980¹⁸ showed that gingival inflammation is reduced in patients who had poor oral hygiene at the outset, if they are given professional cleaning at 2-week intervals. If the patients clean that teeth themselves while being watched, the reduction in gingival inflammation is less extensive or no longer observed at all¹⁹.

Kocsis A and Kocsis G²⁰ have concluded that the state of oral hygiene in people who have completed orthodontic therapy is better at the same age than in untreated persons. Appliances were found to be free of plaque if they were cleaned by toothbrush, toothpaste or soap under running water twice daily¹⁹. Even retention such as resin under protrusion springs or screw spindles were practically free of plaque. However according to his observations the toothbrush and toothpaste cleaned only the easily accessible surfaces of the appliances adequately. Between 2% and 3% of total deposits remain on the appliances being cleaned. Increased oral hygiene awareness should be considered a significant benefit of orthodontic therapy while at the same time contribute to the overall periodontal health of the patient.

Discussion of Bleeding Index

The gingival bleeding index by Ainamo and Bay 1975²¹ in the present study is simple, yet effective. There was no significant difference between bleeding index values of males and females. Brushing technique groups did not show any significant difference but the highest BI value was of flossing & brushing group with a mean of 17.50%, followed by teeth and gums with 14.52%. An investigation by Artun and coworkers 1998²² reported a mean gingival bleeding index value of 20% during excessive proclination of the mandibular incisors.

The clinical parameters available for the diagno

sis of progressive periodontitis have been extensively research by Haffajee et al 1983²³, who concluded from their longitudinal study, that only the visible plaque and bleeding in response to periodontal probing are related to progressive periodontitis. Bleeding as such, however, is not a perfect diagnostic instrument. A study by Lang and co-workers 1983²⁴ indicated progressive disease in only 6% of those with bleeding. Not bleeding, however, is a reliable indicator for periodontal health since 98% of non-bleeding sites do not develop periodontal breakdown.

Discussion of Gingival Index & Frequency Distribution

There is not significant difference between gingival index values of males and females. In the age groups, the biggest value was of 18.5 age group with a mean value of 1.65 and this value was significantly different from the age group 21.5 with a value of 1.61 ($P < 0.05$). There was no difference between the other age groups.

When compared to the brushing technique, flossing and brushing technique showed a slight increase in the mean gingival index value of 1.72. When compared to the other brushing techniques, the values were insignificant. Komhauser and coworkers²⁵ reported a mean GI value of 0.67 immediately after correction of anterior crossbites and 0.47 after 3 months of correction, showing that mild gingival inflammation existed during the active treatment phase, and it decreased right after the completion of treatment.

According to the mean gingival index FD values of both the sexes, half of the mouth showed sites with moderate to severe inflammation. The mean gingival index value for males was 1.59, while the mean female gingival index value was 1.64, respectively. No significant difference was noted in the gingival index frequency distribution values of male and female patients when compared to the age code, the 18.5 age group had the highest GI FD value of 55.01, followed by 21.5 age group with 53.16. However, no significant difference was noted when compared to the other age groups.

In the brushing technique, the teeth and gums brushing showed an increased Mean GI FD value of 56.30, followed by teeth only technique with 52.03. No significant difference was noted when compared to other brushing techniques.

All our groups showed values presenting mild to

moderate gingival index condition. But when we consider frequency distribution of the gingival index (male 53.7; females 53.0), the means are presenting half the sites with worse gingival index condition. Because we calculated sites having values 2 and over 2, while evaluating the frequency distribution.

Yeung and co-workers¹³ reported a GI FD value of 43% to as high as 63% in their orthodontic patient study group with mild to moderate inflammation during orthodontic treatment, which was similar to our values. They also reported that the oral hygiene program induced in the experimental group significantly lowered scores in the measured clinical indices as compared to the control group, which did not receive any oral hygiene training.

Zachrisson and Zachrisson⁵ reported a greater increase in the gingival index scores one to two months after placement of orthodontic appliances. Thereafter, gingival index scores showed increased at subsequent appointments throughout the active treatment phase. A sharp decline to near baseline values in gingival index scores was reported after the removal of the appliance. Similar studies have shown the same pattern of change in the gingival index^{11,26}.

Discussion of Periodontal Pocket Depth & Frequency Distribution

The mean PPD values of males and females were not significantly different. The male PPD value obtained was 1.63 as compared to the female mean PPD value of 1.68. When compared to the age code no significant difference was observed in all the age groups.

Flossing and brushing showed the highest mean PPD value of 1.88 as compared to teeth only brushing technique with 1.65 and teeth and gums with 1.63, respectively. The mean periodontal pocket depth frequently distribution (PPD FD) values obtained from both the sexes showed that around 58% of the sites in the mouth were presenting periodontal pocket depths of 2mm or over.

Komhauser and workers²⁵ calculated a mean PPD value of 2.64 mm immediately after correction of anterior crossbites, which decreased slightly to 2.57 mm after 3 months of active treatment.

There is no significant difference of the mean PPD FD values between the sexes. However the male PPD FD value of 58.95 was slightly higher as compared to the female mean PPD FD value of 55.69 the 18.5 age

group showed a slightly high mean PPD FD value of 58.54 followed by 21.5 age group with 57.52 and the 14.2 age group with 55.54. No significant difference was noted when compared to the age groups.

Yeung and co workers¹³ reported a frequency distribution of 3 mm pocket depth in between 24% and 47%, and 4 mm pocket depths between 3% to 19% during the orthodontic treatment phase.

Discussion of Ortho-Plaque Index

There was no significant difference between ortho plaque index, values of males and females. In the age groups the biggest value was of 18.5 age group with a mean OPI value of 42.92 and this value was significantly different from the age group 21.5. Comparison of 14.5 and 21.5 age groups also revealed a significant difference between the groups.

When compared to the diet groups, sweets showed an increased mean OPI value of 42.97 followed by fruits with 42.15. No significant difference was observed when compared to the diet groups.

As observed, the teeth and gums brushing technique showed a mean OPI index of 44.88, followed by teeth only brushing technique with 41.65. No significant difference was noted in the brushing technique comparison groups.

Komhauser and co workers²⁵ reported a mean plaque index score of 31.00 immediately after correction of anterior crossbites, and 25.00 values 6 months after correction of the crossbite. It was also observed that the plaque index values decreased to nearly half the pre treatment value of 46.00, respectively.

Huser and co workers²⁷ showed a slight increase in the plaque index values after placement of orthodontic bands as compared to the control sites.

Yeung and co workers¹³ reported moderate plaque accumulation between 18% to 29% of the patients undergoing orthodontic treatment. While an abundance of soft matter was reported in 2% to 11% of the cases encountered.

CONCLUSION

- 1 Both the sexes practiced good oral hygiene procedures. However, females showed more oral hygiene awareness as compared to their male counterparts.
- 2 The majority of the orthodontic patients recorded that they brushed twice daily.

- 3 Bleeding index values during orthodontic treatment was not affected from age, sex, diet and brushing technique.
- 4 Gingival index values of orthodontic patients presented mild to moderate inflammation. The values were insignificant when compared to the age, sex, diet and brushing technique.
- 5 The Gingival index frequency distribution presented that in orthodontic patients half of the side were showing bad gingival conditions. Comparison with age, sex, diet and brushing technique was insignificant.
- 6 The periodontal pocket depth values of orthodontic patients were in normal range, but when considering deep pockets, their percentage exhibited that half of the sites had deeper pockets.
- 7 Plaque index of patients during orthodontic treatment presented that they had fair or average oral hygiene. The values were insignificant when compared to the age, sex, diet and brushing technique.

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