

## Appropriate Oral Hygiene Motivation Method for Patients with Fixed Appliances

Zuhal Yetkin Ay<sup>a</sup>; M. Özgür Sayın<sup>b</sup>; Yener Özat<sup>c</sup>; Tuba Goster<sup>c</sup>;  
A. Onur Atilla<sup>d</sup>; F. Yeşim Bozkurt<sup>e</sup>

### ABSTRACT

**Objective:** To determine the most appropriate oral hygiene motivation method (OHMM) for orthodontic patients with fixed appliances.

**Materials and Methods:** A total of 150 orthodontic patients, scheduled for their regular controls, were included in this study. The patients were divided into five groups (n = 30) according to the verbal OHMM and instructed as follows: only verbal information (V), verbal information with demonstration on model (M), verbal information with demonstration on model and self application by the patient (M+A), verbal information using the illustration catalog (I), and verbal information using the illustration catalog and self application by the patient (I+A). All of the applications of the patients were made under the supervision of the clinicians. The periodontal parameters (plaque index [PI], gingival index [GI], and bleeding on probing [BOP]) were recorded at the baseline (before the instructions of the OHMM), 1 week later, and 4 weeks after the OHMM.

**Results:** All periodontal parameters showed significant decreases after 4 weeks in all OHMM groups ( $P < .05$ ). I+A group has significantly lower PI scores and BOP percentages than the other groups ( $P < .05$ ) after 4 weeks. The difference between the V group and M+A, I, and I+A groups in the GI scores were significant ( $P < .05$ ), and the I+A group has presented the lowest GI score.

**Conclusions:** The OHMM applied by the patients under the supervision of the clinician seemed to be more successful in the elimination of plaque and inflammatory symptoms in patients with fixed appliances.

**KEY WORDS:** Oral hygiene motivation; Orthodontic patient; Plaque elimination

### INTRODUCTION

Orthodontic treatment with fixed appliances alters the oral environment, increases plaque amount,<sup>1</sup> changes the composition of the flora,<sup>2</sup> and complicates

the cleaning for the patient.<sup>3</sup> Gingivitis and enamel decalcification<sup>4,5</sup> around fixed appliances are frequent side effects when the preventive programs have not been implemented.<sup>6</sup> Oral cleaning becomes more difficult with the presence of the orthodontic appliances and their components. Thus, the elimination of plaque is the main target to prevent and/or overcome the problems listed above.

In literature, numerous studies investigated the most appropriate plaque elimination method for orthodontic patients. However, they largely differ with respect to content, design, and duration. The variability of the methods used in the previous studies may be the cause of the conflicting results. Some of these studies compared the effectiveness of manual or electric toothbrushes on plaque elimination.<sup>7-10</sup> Others evaluated the efficiency of toothpastes and mouthwashes with different ingredients,<sup>3,11-13</sup> and oral irrigators<sup>14,15</sup> on gingival health and plaque elimination.

Few studies in the literature evaluated the oral hy-

<sup>a</sup> Assistant Professor, Department of Periodontology, Faculty of Dentistry, University of Suleyman Demirel, Isparta, Turkey.

<sup>b</sup> Associate Professor, Department of Orthodontics, Faculty of Dentistry, University of Suleyman Demirel, Isparta, Turkey.

<sup>c</sup> Research Assistant, Department of Periodontology, Faculty of Dentistry, University of Suleyman Demirel, Isparta, Turkey.

<sup>d</sup> Research Assistant, Department of Orthodontics, Faculty of Dentistry, University of Suleyman Demirel, Isparta, Turkey.

<sup>e</sup> Professor, Department of Periodontology, Faculty of Dentistry, University of Suleyman Demirel, Isparta, Turkey.

Corresponding author: Dr M. Özgür Sayın, Suleyman Demirel Universitesi, Dishekimligi Fakultesi, Ortodonti A.B.D, Cunur, Isparta, 32260 Turkey  
(e-mail: sayin@med.sdu.edu.tr)

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giene motivation methods (OHMM) in orthodontic patients using various methods. These methods are generally classified as verbal,<sup>16-18</sup> written,<sup>19</sup> or visual based (videotapes).<sup>20</sup> Boyd<sup>18</sup> evaluated the effectiveness of the self-monitoring plaque control. He determined that the plaque control instruction using a disclosant solution was more effective in plaque elimination when compared to the group receiving only plaque control instructions. Huber<sup>16</sup> investigated the efficiency of repeated professional prophylaxis together with reinforced oral hygiene instruction on a monthly basis and found that the monthly professional prophylaxis had a significant effect in reducing the gingival enlargement routinely associated with fixed orthodontic appliances. Yeung<sup>17</sup> conducted an oral hygiene program consisting of four weekly sessions of oral health education, instruction of plaque control techniques, and reviews in the plaque removal performance. They have found significantly lower bleeding on probing (BOP), gingival index (GI), and plaque index (PI) scores in the experimental group. McGlynn<sup>19</sup> studied the effectiveness of an oral hygiene booklet and repeated lectures with professional prophylaxis. No significant differences between the booklet and lecture groups were found. On the other hand, Lees et al<sup>20</sup> compared written, verbal, and videotape oral hygiene instruction methods for the patients with fixed appliances. They found no significant differences between the written, verbal, and videotape instruction methods.

To our knowledge, no previous studies in the English literature investigated the efficiency of verbal OHMM applied by the patient under the supervision of the dentists/orthodontists. We hypothesize that solely verbal recommendations are not enough to achieve optimum plaque removal, and that the ameliorations of the patients' inaccurate oral hygiene efforts by the specialists at the same session are essential. The aim of the present study is to compare the efficiency of verbal OHMM methods with or without adjunctive tools applied by the patient under the supervision of the clinician.

## MATERIALS AND METHODS

After the proposed study was approved by the appropriate institutional review board, a total of 150 orthodontic patients (78 female and 72 male healthy children, mean age  $15.16 \pm 0.1$  years) undergoing fixed orthodontic treatment (<1 year) were included in the present study (scheduled between June 2006 and August 2006). The same type of orthodontic toothbrushes, interdental brushes, and toothpastes were provided. The Bass technique and interdental cleaning with interdental brushes were instructed with different verbal OHMM by the same clinician using two adjunctive

tools: models (with fixed appliances) and illustrations (the catalog of the commercial firm; Oral B, Procter & Gamble, Cincinnati, Ohio). Parents were not allowed to accompany the patients during the instruction sessions. The study group was randomly divided into five groups in accordance to their OHMM as follows:

- Group I. Only verbal information (V)
- Group II. Verbal information with demonstration on model (M)
- Group III. Verbal information with demonstration on model and self application by the patient (M+A) under the supervision of the clinician and corrections made if necessary
- Group IV. Verbal information using the illustration catalog (I)
- Group V. Verbal information using the illustration catalog and self application by the patient (I+A) under the supervision of the clinician and corrections made if necessary

The periodontal parameters PI,<sup>21</sup> GI,<sup>22</sup> and BOP<sup>23</sup> were recorded by two skilled clinicians calibrated before the study. After baseline recordings, the patients were seen 1 week and 4 weeks later and the recordings were repeated.

## Statistical Method

The statistical analyses were made using InStat (GraphPad Software Inc, San Diego, Calif). The presence of significant differences between the OHMM groups at baseline, and at the first and fourth week was determined with the Friedman's test. Dunn's posterior test was used to determine the group pairs. The comparisons were made with the Wilcoxon paired ranks test. The data were presented as mean  $\pm$  standard error, and  $P < .05$  was considered to be statistically significant.

## RESULTS

All 150 patients cooperated with the study procedures. The age and gender distributions of each group are presented in Table 1. At baseline, no significant differences were observed between the OHMM groups in PI, GI, and BOP values ( $P > .05$ ) (Figures 1 through 3).

### First Week Results

After 1 week, all of the periodontal parameters showed significant decreases in all OHMM groups ( $P < .01$ ) (Figures 1 through 3). The PI values presented no significant differences after 1 week when compared to the baseline values in Group I ( $P < .05$ ) (Figure 1). In the GI scores, differences were noted between the

**Table 1.** The Distribution of the Age (Years) and Gender of the Study Groups<sup>a</sup>

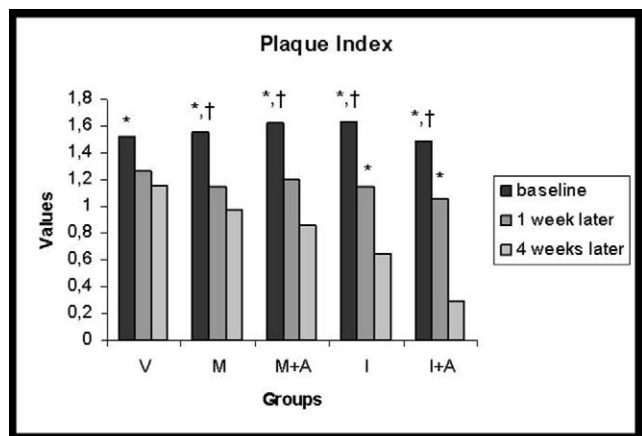
		n	Age		n	Age	
			(Mean ± SD)			(Mean ± SD)	
V	Male	17	15.9 ± 0.2	30	16.03 ± 0.2		
	Female	13	16.2 ± 0.2				
M	Male	14	14.6 ± 0.1	30	15.4 ± 0.2		
	Female	16	15.6 ± 0.2				
M+A	Male	12	14.7 ± 0.2	30	14.58 ± 0.1		
	Female	18	14.5 ± 0.1				
I	Male	13	15.5 ± 0.1	30	15.16 ± 0.1		
	Female	17	14.9 ± 0.1				
I+A	Male	16	14.9 ± 0.1	30	14.9 ± 0.1		
	Female	14	15.0 ± 0.1				

<sup>a</sup> V indicates verbal; M, model; M+A, model + application; I, illustration; I+A, illustration + application.

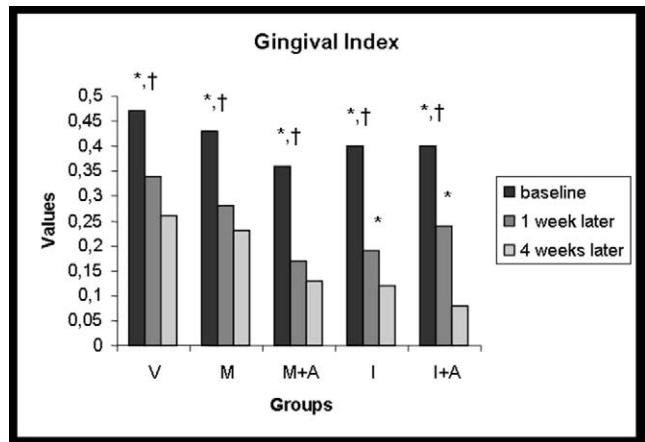
baseline and first week measurements in all groups ( $P < .05$ ) (Figure 2). The GI values were significantly lower in Group III than in Group I and Group II ( $P < .05$ ). Group I and IV presented significant differences in GI scores, and the GI score of Group IV was significantly lower than Group I ( $P < .01$ ). The BOP percentages exhibited significant decreases in Groups IV and V ( $P < .05$ ) (Figure 3) when compared to the baseline percentages.

**Fourth Week Results**

After 4 weeks, all of the periodontal parameters decreased significantly when compared to the baseline values ( $P < .05$ ) (Figures 1 through 3). The fourth week measurements were lower than the first week in PI scores in Groups III, IV, and V ( $P < .05$ ) (Figure 1). The GI and BOP values showed significant decreases between Group IV and V between the first and fourth week ( $P < .05$ ) (Figures 2 and 3).



**Figure 1.** The statistically significant differences of PI values of the groups between the time intervals. V indicates verbal; M, model; M+A, model + application; I, illustration; I+A, illustration + application. † statistically significantly different than the first week, \* statistically significantly different than the fourth week ( $P < .01$ ).

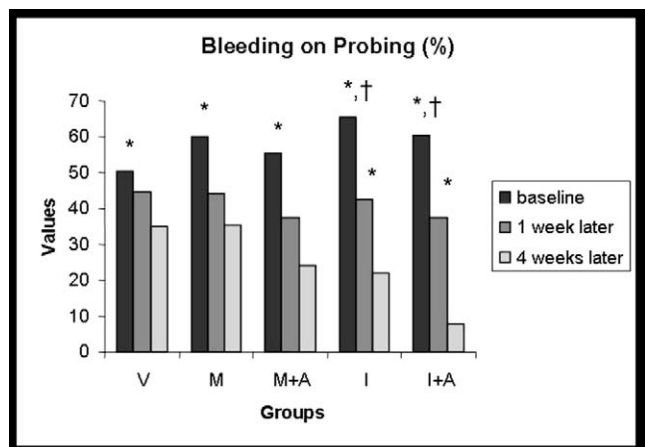


**Figure 2.** The statistically significant differences of GI values of the groups between the time intervals. V indicates verbal; M, model; M+A, model + application; I, illustration; I+A, illustration + application. † statistically significantly different than the first week, \* statistically significantly different than the fourth week ( $P < .01$ ).

The PI values were significantly lower in Group V than in Groups I, II, III, and IV ( $P < .05$ ) (Figure 1). Group V exhibited significantly lower GI scores than Groups I and II ( $P < .05$ ). The GI score was lowest in Group V, followed by Groups IV, III, II, and I, respectively (Figure 2). The BOP percentages decreased after 4 weeks in all groups ( $P < .05$ ). Group V had significantly lower BOP percentages than the other four OHMM groups (Figure 3). The BOP percentages of the other four OHMM groups were similar.

**DISCUSSION**

The problems faced during fixed orthodontic treatment could be listed as chronic hyperplastic gingivitis



**Figure 3.** The statistically significant differences of BOP percentages of the groups between the time intervals; V indicates verbal; M, model; M+A, model + application; I, illustration; I+A, illustration + application. † statistically significantly different than the first week, \* statistically significantly different than the fourth week ( $P < .01$ ).

with increased pocket depths, white spot lesions, decalcifications, and cavity formation because of the difficulty in properly cleaning teeth covered by brackets and other appliance components.<sup>24-27</sup>

The oral hygiene programs before the onset of the orthodontic treatment were recommended to prevent these deleterious effects.<sup>28</sup> In our study, all patients received oral hygiene education before treatment, and the patients who were not found qualified in plaque elimination were not placed on the waiting list for orthodontic treatment. These patients were referred to the Department of Periodontology for further treatment.

It is well known that it becomes more difficult to keep the teeth clean and maintain a high oral hygiene level after appliances are placed.<sup>20</sup> In this sense, the OHMM have gained particular interest. In our opinion, the most important advantage of the verbal technique is to have the opportunity to communicate with the patient and to gain his or her trust. In our study all of the OHMM resulted in decreased clinical parameter scores as expected. The verbal technique in instructing the oral hygiene procedures was successful in our study sample, although the adolescents were not accompanied by their parents. On the contrary, Thomson et al<sup>29</sup> stated that adolescent patients should not be given verbal information alone.

On the other hand, verbal information using the illustration catalog and self application by the patient (I+A) was more effective in plaque elimination and decreasing the GI and BOP scores than the other OHMM. This result supports our hypothesis that self application of OHMM by the patient is beneficial in plaque elimination. Concordantly, Thomson et al<sup>29</sup> reported that verbal instructions should always be supplemented by written or visual information.

It was interesting to find that the two-dimensional tool (illustration in catalog) has an additional improving effect compared with the three-dimensional tool (bracket fixed model) in the PI and BOP scores. It is well known that materials used in educational purposes have to be familiar to the target group. The illustrations in the catalog are more familiar to adolescents than the models because of their common use for educational purposes in our country. It is also well known that three-dimensional perception is already developed in adolescents. This situation is supported by our finding that the self application by the patient after the demonstration on the model (M+A) and the self application by the patient after the demonstration on the illustration (I+A) exhibited no significant difference in GI scores. In addition, the three-dimensional tool could have distracted their attention. At this point, the importance of self application by the children and corrections made by the clinician can be easily realized.

According to our clinical observations, self applications by the children holding their attention and further corrections made by their dentist seemed to be didactic and more effective. Clark<sup>30</sup> has pointed out the importance of the motivation of the orthodontists for an oral health program. He stated that a comment at each appointment telling the patient about the effectiveness of cleaning is especially helpful. In addition to his recommendations about the feedback, which is offered with kindness, objectivity, and respect, we suggest that the enforcement of the oral hygiene technique with the application under the supervision of the orthodontists is essential.

When interpreting the results of this study, two points should be considered: first, the results of our study may not be valid for adults since some authors reported that adolescents exhibit a higher level of supragingival plaque and higher incidence of gingivitis than adults.<sup>31-33</sup> Second, this study was conducted on orthodontic patients with fixed appliances. For this reason the results of this study may not be valid for patients using clear, removable appliances. Some authors reported that unlike treatment with fixed appliances, treatment with removable appliances had no adverse effects on gingival health during treatment.<sup>34,35</sup>

One could speculate that the main limitation of this study may be the short period of duration. However, in the long term studies, the improvement of plaque elimination may be related to the correction of the crowding, which must be taken into consideration.

## CONCLUSIONS

- The self applications of OHMM by the patients under the supervision of orthodontists seem to be more successful in decreasing the PI and inflammatory markers (GI, BOP).
- Verbal information using the illustration catalog and self application by the patient (I+A group) was found to be more effective in reducing PI, GI, and BOP scores than the other groups after 4 weeks.

## REFERENCES

1. Pender N. Aspects of oral health in orthodontic patients. *Br J Orthod.* 1986;13:95-103.
2. Lundström F, Krasse B. *Streptococcus mutans* and lactobacilli frequency in orthodontic patients; the effects of chlorhexidine treatment. *Eur J Orthod.* 1987;9:109-116.
3. Olympio KPK, Bardal PAP, de M Bastos JR, Buzalaf MAR. Effectiveness of a chlorhexidine dentrifice in orthodontic patients: a randomized-controlled trial. *J Clin Periodontol.* 2006;33:421-426.
4. Arends J, Christofferson I. The nature of early caries lesions in enamel. *J Dent Res.* 1986;65:2-11.
5. O'Reilly MM, Featherstone JD. Demineralization and remineralization around orthodontic appliances: an in vivo study. *Am J Orthod Dentofacial Orthop.* 1987;92:33-40.

6. Zachrisson BU. Direct bonding in orthodontics. *Am J Orthod*. 1977;71:173–189.
7. Heasman P, Wilson Z, MacGregor I, Kelly P. Comparative study of electric and manual toothbrushes in patients with fixed orthodontic appliances. *Am J Orthod Dentofacial Orthop*. 1998;114:45–49.
8. Clerehugh V, Williams P, Shaw WC, Worthington HV, Warren P. A practice-based randomised controlled trial of the efficacy of an electric and a manual toothbrush on gingival health in patients with fixed orthodontic appliances. *J Dent*. 1998;26:633–639.
9. Thienpont V, Dermaut LR, Van Maele G. Comparative study of 2 electric and 2 manual toothbrushes in patients with fixed orthodontic appliances. *Am J Orthod Dentofacial Orthop*. 2001;120:353–360.
10. Hickman J, Millett DT, Sander L, Brown E, Love J. Powered vs manual tooth brushing in fixed appliance patients: a short term randomized clinical trial. *Angle Orthod*. 2002;72:135–140.
11. Ogaard B, Alm AA, Larsson E, Adolfsson U. A prospective, randomized clinical study on the effects of an amine fluoride/stannous fluoride toothpaste/mouthrinse on plaque, gingivitis and initial caries lesion development in orthodontic patients. *Eur J Orthod*. 2006;28:8–12.
12. Pontier JP, Pine C, Jackson DL, DiDonato AK, Close J, Moore PA. Efficacy of a prebrushing rinse for orthodontic patients. *Clin Prev Dent*. 1990;12:12–17.
13. Ramaglia L, Sbordone L, Ciaglia RN, Barone A, Martina R. A clinical comparison of the efficacy and efficiency of two professional prophylaxis procedures in orthodontic patients. *Eur J Orthod*. 1999;21:423–428.
14. Burch JG, Lanese R, Ngan P. A two-month study of the effects of oral irrigation and automatic toothbrush use in an adult orthodontic population with fixed appliances. *Am J Orthod Dentofacial Orthop*. 1994;106:121–126.
15. Attarzadeh F. Water irrigating devices for the orthodontic patient. *Int J Orthod*. 1990;28:17–22.
16. Huber SJ, Vernino AR, Nanda RS. Professional prophylaxis and its effect on the periodontium of full-banded orthodontic patients. *Angle Orthod*. 1972;42:26–34.
17. Yeung SC, Howell S, Fahey P. Oral hygiene program for orthodontic patients. *Am J Orthod Dentofacial Orthop*. 1989;96:208–213.
18. Boyd RL. Longitudinal evaluation of a system for self-monitoring plaque control effectiveness in orthodontic patients. *J Clin Periodontol*. 1983;10:380–388.
19. McGlynn FD, Le Compte EJ, Thomas RG, Courts FJ, Melamed BG. Effect of behavioral self-management on oral hygiene adherence among orthodontic patients. *Am J Orthod*. 1987;91:321–327.
20. Lees A, Rock WP. A comparison between written, verbal, and videotape oral hygiene instruction for patients with fixed appliances. *J Orthod*. 2000;27:323–328.
21. Silness J, Løe H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand*. 1964;22:121–135.
22. Løe H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontol Scand*. 1963;21:533–551.
23. Greenstein G. The role of bleeding upon probing in the diagnosis of periodontal disease. A literature review. *J Periodontol*. 1984;55:684–688.
24. Mitchell L. Decalcification during orthodontic treatment with fixed appliances—an overview. *Br J Orthod*. 1992;19:199–205.
25. Zachrisson BU, Zachrisson S. Caries incidence and oral hygiene during orthodontic treatment. *Scand J Dent Res*. 1971;79:394–401.
26. Alexander SA. Effects of orthodontic attachments on the gingival health of permanent second molars. *Am J Orthod Dentofacial Orthop*. 1991;100:337–340.
27. Gorelick L, Geiger AM, Gwinnett AJ. Incidence of white spot formation after bonding and banding. *Am J Orthod*. 1982;81:93–98.
28. Türkkahraman H, Sayın O, Bozkurt FY, Yetkin Z, Kaya S, Önal S. Archwire ligation techniques, microbial colonization, and periodontal status in orthodontically treated patients. *Angle Orthod*. 2005;75:227–232.
29. Thomson AM, Cunningham SJ, Hunt NP. A comparison of information retention at an initial orthodontic consultation. *Eur J Orthod*. 2001;23:169–178.
30. Clark JR. Oral hygiene in the orthodontic practice: motivation, responsibilities, and concepts. *Am J Orthod*. 1976;69:72–82.
31. Boyd RL, Leggott PJ, Quinn RS, Eakle WS, Chambers D. Periodontal implications of orthodontic treatment in adults with reduced or normal periodontal tissues versus those of adolescents. *Am J Orthod Dentofacial Orthop*. 1989;96:191–199.
32. Boyd RL, Baumrind S. Periodontal consideration in the use of bonds or bands on molars in adolescents and adults. *Angle Orthod*. 1992;62:117–126.
33. Hamp S, Lundstrom F, Nyman S. Periodontal conditions in adolescents subjected to multiband orthodontic treatment with controlled oral hygiene. *Eur J Orthod*. 1982;4:77–86.
34. Taylor MG, McGorray SP, Durrett S, et al. Effect of Invisalign aligners on periodontal tissues [abstract]. *J Dent Res*. 2003; 1483.
35. Clements KM, Bollen AM, Huang G, King G, Hujoel P, Ma T. Activation time and material stiffness of sequential removable orthodontic appliances. Part 2: dental improvements. *Am J Orthod Dentofacial Orthop*. 2003;124:502–508.