

Assessment of oral hygiene maintenance in 12-18-year-old children and teenagers with fixed orthodontic appliances

Nina Smolyar¹, Natalya Chukhray¹, Markiy Lesitskiy¹, Yuriy Rybert², Khrystyna Musiy-Sementsiv¹

SUMMARY

Background. Good oral hygiene is very important to ensure successful orthodontic treatment. Orthodontic treatments may cause plaque accumulation and in this way the development of caries and periodontal diseases which are basically caused by dental plaque. The aim of this study was to compare the features of oral hygiene among different age groups and genders in patients with fixed orthodontic appliances.

Material and methods. The study involves 118 patients aged 12 to 18 (64 males (54.2%) and 54 females (45.8%)) with fixed orthodontic appliances from the Department of Orthodontics at Danylo Halytsky Lviv National Medical University. The patients completed the questionnaires which included 19 questions about their oral hygiene.

Results. It was revealed that 59 females (92.19±3.35%) believe that oral hygiene is important, but among the males number of such persons have been significantly lower – 41 (75.93±5.82%), $p < 0.05$. Statistically significant result was obtained showing that females (46 patients (71.88±5.62%)) use interdental brushes more regular (every day) than males (26 (48.15±6.80%)), $p < 0.05$. Comparing the differences between the regularity of teeth brushing in different age groups showed that 53 patients (82.81±4.72%) aged 12 to 15 and 46 (85.19±4.83%) aged 16 to 18 claimed that they brush their teeth regularly, twice a day, 8 (12.50±4.13%) and 6 (11.11±4.28%), respectively – once a day.

Conclusion. In patients with fixed orthodontic appliances oral hygiene of 16-18-year-old respondents is better than the oral hygiene of 12-15-year-old ones.

Keywords: oral hygiene, fixed orthodontic appliance, children, patients.

INTRODUCTION

According to the data of the thorough investigation the frequency of malocclusion has increased during the last years (17). That is why there is an increase in the number of patients that are seeking orthodontic treatment. The most important motivation for orthodontic treatment is to achieve improvement in appearance and the fact that in connection with this change some psychological problems could be reduced. These factors contribute not only to the position but the esthetic appearance of the tooth itself (6, 20).

¹Department of Orthodontics, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

²Department of Therapeutic Dentistry of Postgraduate Training Faculty, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

Address correspondence to Natalya Chukhray, Department of Orthodontics, Danylo Halytsky Lviv National Medical University, Pekarska 60b, Lviv, Ukraine.
E-mail address: nchukhray@gmail.com

However, after the beginning of the orthodontic treatment, especially with fixed appliances, patients have to deal with some difficulties concerning eating habits, pain and discomfort, more careful toothbrushing, regular visits to the orthodontist for a long time etc. In some cases orthodontic treatments can attribute to caries preventive intervention, when tooth movements may reduce crowding or other anomalies, thus can contribute to the effectiveness of proper oral hygiene (5, 14). On the other hand, orthodontic treatments may cause or aggravate plaque accumulation and, in its turn, the development of caries and periodontal diseases which are basically caused by dental plaque (12).

It is very important for the orthodontist at the beginning of the orthodontic treatment to talk to parents and their children on the subject of taking care of oral hygiene. The following things should be discussed in detail: the method and frequency of

teeth brushing, using interdental toothbrush, dental floss, different special brushes, mouthwash and an oral irrigator, toothpastes with fluoride and calcium (8). Also, the level of enamel resistance should be taken into account. On one hand, the results of the study showed that in children with caries resistant enamel, malocclusions occur much more commonly compared to children with caries susceptible enamel (18, 19). On the other hand, patients with fixed orthodontic appliances should maintain good oral hygiene, especially around brackets, tubes, bands, ligatures wires and elastics where food residues, microbial flora and dental plaque can be accumulated. Thus, extra oral hygiene measures are recommended because bands, brackets, otherwise, cause enamel demineralization (white spots), periodontal diseases, halitosis (1, 9, 11).

Bevinagidad *et al.* (2020) (4) reported that after six months from the beginning of the orthodontic treatment there is a statistically significant increase in alkaline phosphatase levels, orthodontic plaque index score, gingival index score and bleeding on probing index score. A statistically significant reduction was seen with respect to levels of calcium and pH. Maxillary canines and lateral incisors were most affected teeth with “white spot” lesions (a subsurface area with the most of the mineral loss beneath a relatively intact enamel surface). Salivary reservoir of calcium and phosphorous counteracts the demineralization and encourages re-mineralization providing protection against caries.

Enamel demineralization is the worst adverse effect that impairs the aesthetics of fixed orthodontic treatment. The development of “white spot” lesions occurs due to prolonged accumulation of bacterial plaques and is associated with high production of acid by acidogenic bacteria. Orthodontic appliances can influence the ability to clean teeth, which can affect oral microflora, and increase the levels of acidogenic plaque bacteria, which, in its turn, leads to the development of dental biofilm, especially around brackets. Within such a biofilm, *Streptococcus* mutants are the main etiological factor responsible for initiation and progression of tooth decay (7).

Gingivitis may develop in patients who do not institute proper oral hygiene measures. Patients often exhibit gingival hypertrophy, bleeding, increased plaque accumulation and calculus formation during orthodontic treatment. Gingival hyperplasia can be a problem around orthodontic bands, leading to pseudopocketing and giving the illusion of attachment loss. The orthodontist should control the disease and sufficiently motivate the patient. Orthodontic treat-

ment produces a local change in the oral ecosystem with changes in the composition of bacterial plaque and, consequently, the development of gingivitis. The study showed that fixed orthodontic appliances alter the ecology of oral cavity by introducing new stagnant areas available for colonization of bacteria, and it showed that fixed orthodontic appliances have a direct effect on plaque index and total bacterial count (15).

Therefore, it is a challenging task to maintain acceptable oral hygiene in patients undergoing fixed orthodontic care in order to prevent dental caries and gingival inflammation. Since oral hygiene behavior has an important role in oral health care, it was the purpose of this study to assess oral hygiene behavior among patients undergoing orthodontic treatment with fixed orthodontic appliances.

MATERIAL AND METHODS

Study design

The study includes children and teenagers that were all being treated with fixed orthodontic appliances at the Department of Orthodontics at Danylo Halytskyi Lviv National Medical University during the period from September 2019 to November 2020. The study involved patients aged 12 to 18. The study was reviewed and approved by Biomedical Ethics Committee (prot. No. 2, 17.02.2020). After an informed consent signed by the parents of the patients who were under 18 years old, questionnaires were given to the patients. The patients who were engaged in the study were asked to complete questionnaires face-to-face with one of the research team members so that any hesitations could be addressed directly. A total of 118 patients were interviewed.

Data collection

Data was collected from questionnaires which included 19 questions. First part consists of the questions about general information (e.g. age, gender). In the further questions, patients were asked about general aspects of their oral hygiene (frequency, method and means of brushing). Other questions were more specific and were more concerned with changes in oral hygiene after the beginning of the orthodontic treatment. Some questions included information about the means and measures recommended by orthodontist to maintain oral hygiene during the orthodontic treatment.

Statistical Analysis

The statistical analysis was performed using Microsoft Excel and Statistics 22.0. All data ob-

tained were subjected to statistical analysis using Student's t test (16).

RESULTS

The study involved 118 patients aged 12 to 18 (64 males and 54 females) who were treated with fixed orthodontic appliances. According to the age, the patients were divided into two groups – one group (12-15-year-old) containing 64 patients and another group (16-18-year-old) containing 54 persons. Analyzing the answers to the question “Do you think that oral hygiene is important to you?” was found that on average, 100 respondents (84.75±3.31%) answered in the affirmative. Moreover, 51 patients (79.69±5.03%) among 12-15-year-old children, answered in the affirmative. In the group of 16-18-year-old patients the number of such persons is increased up to 49 (90.74±3.94%). Gender analysis showed that 59 females (92.19±3.35%) believe that oral hygiene is important, but among males the number of such persons have been significantly lower – 41 (75.93±5.82%), $p < 0.05$ (Table 1).

When evaluating the regularity of teeth brushing among interviewed children it was found that 99 out of 118 respondents (83.90±3.38%) brush their teeth regularly, twice a day, 14 (11.86±2.98%) – once a day, 3 (2.54±1.45%) – irregularly and only 2 (1.16±1.19%) more than three times a day (Table 2). Comparing the differences between the regularity of teeth brushing in different age groups showed that 53 patients (82.81±4.72%) aged 12 to 15 and 46 (85.19±4.83%) aged 16 to 18 claimed that they brush their teeth regularly, twice a day, 8 (12.50±4.13%) and 6 (11.11±4.28%), respectively – once a day. Meanwhile, just 2 (3.70±2.57%) 16-18-year-old patients brush their teeth 3 times a day and more and 3 (4.69±2.64%) 12-15-year-old patients do it irregularly.

Assessing the differences in answers to this question in relation to the gender showed that 55 females (85.94±4.35%) and 44 males

(81.48±5.29%) brush their teeth regularly ($p > 0.05$), twice a day; 7 (10.94±3.90%) and 7 (12.96±4.57%), respectively – once a day, ($p > 0.05$) (Table 3). It was found that 2 females (3.13±2.17%) brush their teeth 3 and more times a day, among males such persons were absent.

Only 3 males (5.56±3.12%) brush their teeth irregularly. So, females brush their teeth more regularly than males.

When determining which measures patients use for their oral health during their orthodontic treat-

Table 1. Answers to the question “Do you think that oral hygiene is important to you?” among different age groups and genders

Age (in years)	Gender	
	Female	Male
12-15	31 (86.11±5.76%)	20 (71.43±8.54%)*
16-18	28 (100%)	21 (80.77±7.73%)**

p – the degree of reliability in relation to females; * – $p > 0.05$; ** – $p < 0.05$.

Table 2. Teeth brushing frequency among different age groups

Frequency of teeth brushing (times a day)	Age	
	12-15	16-18
3 and more	–	2 (3.70±2.57%)
2	53 (82.81±4.72%)	46 (85.19±4.83%)*
1	8 (12.50±4.13%)	6 (11.11±4.28%)*
Irregularly	3 (4.69±2.64%)	–

p – the degree of reliability in relation to females; * – $p > 0.05$.

Table 3. Teeth brushing frequency among different age groups

Frequency of teeth brushing (times a day)	Gender	
	Female	Male
3 and more	2 (3.13±2.17%)	–
2	55 (85.94±4.35%)	44 (81.48±5.29%)
1	7 (10.94±3.90%)	7 (12.96±4.57%)
Irregularly	–	3 (5.56±3.12%)

p – the degree of reliability in relation to females; * – $p > 0.05$.

Table 4. Additional means that patients use during their orthodontic treatment for oral hygiene

Frequency of teeth brushing (times a day)	Gender	
	Female	Male
Interdental brush		
Every day	46 (71.88±5.62%)	26 (48.15±6.80%)**
From time to time	10 (15.63±4.54%)	16 (29.63±6.21%)*
Do not use	8 (12.50±4.13%)	12 (22.22±5.66%)*
Mouthwash		
Every day	40 (62.50±6.05%)	28 (51.85±6.80%)*
From time to time	13 (20.31±5.03%)	14 (25.93±5.96%)*
Do not use	11 (17.19±4.72%)	12 (22.22±5.66%)*

p – the degree of reliability in relation to female: * – $p > 0.05$; * – $p < 0.01$.

ment, it was found that 72 patients ($61.02 \pm 4.49\%$) use interdental brushes for oral hygiene every day, 26 ($22.03 \pm 3.82\%$) – from time to time and 20 ($16.95 \pm 3.45\%$) – do not use at all. As an additional product 68 patients ($57.63 \pm 4.53\%$) use mouthwash every day, 27 ($22.88 \pm 3.87\%$) – from time to time and 23 ($19.49 \pm 3.65\%$) – do not use. Statistically significant result was obtained showing that females (46 patients ($71.88 \pm 5.62\%$)) use interdental brushes more regularly (every day) than males (26 ($48.15 \pm 6.80\%$)), $p < 0.05$ (Table 4). Females (40 persons ($62.50 \pm 6.05\%$)) use mouthwash more regularly than males (28 persons ($51.85 \pm 6.80\%$)), $p > 0.05$.

It was found that only 13 out of 118 patients ($11.02 \pm 2.88\%$) use an electronic toothbrush.

In some cases even patients who brush their teeth regularly and use additional products for their oral hygiene like interdental brush and mouthwash, after 1-2 months revealed white spot lesions, gum inflammation or gum enlargement.

DISCUSSION

This study was carried out to estimate the difference in oral hygiene of 12-18-year-old patients with fixed orthodontic appliances. The results showed that patients brush their teeth regularly, in most cases twice a day. A small number of respondents in their answers indicated that they brush their teeth three and more times a day. According to the study of other authors, after the beginning of orthodontic treatment the accumulation of plaque increases due to the increase in the number of retention areas around brackets and in the interdental areas, changes in oral microflora, changes of salivary calcium, phosphorous, alkaline phosphatase, pH of oral liquid (4). This causes some difficulty in achievement of good oral hygiene condition and leads to the risks of enamel demineralization, periodontal diseases. For this reason, it is not important to use only toothbrush and toothpaste but additional means and measures that will help to provide good oral health during and after orthodontic treatment (1, 8, 10).

The study also showed that the interviewed patients rarely used additional oral hygiene products such as interdental toothbrush, electronic toothbrush and mouthwash that leads to plaque accumulation, enamel demineralization and gum inflammation, halitosis. To avoid such complications, it is important to use toothbrush, electronic toothbrush and mouthwash, fluoride-containing gels or liquids during the whole orthodontic treatment (10, 13).

Tooth brushing is the first line of defense in removing debris and plaque accumulated around orthodontic appliances. During comparing of the differences in oral hygiene maintenance between females and males we found that females brush their teeth more regularly than males. According to the study (9), females carry out the oral hygiene measures more often and more frequently tend to brush their teeth three or more times a day compared to males. Evaluating the differences between different age groups, it was found that patients aged 16 to 18 more often reported brushing their teeth three or more times a day compared to younger patients. Also, patients aged 16 to 18 reported the use of more various products for oral hygiene, and had more intensive changes in their oral health after the placement of orthodontic appliances.

Oral hygiene becomes greatly complicated following the placement of fixed orthodontic appliances. Consequently, patients with fixed orthodontic appliances are at an increased risk concerning development of dental caries and gingivitis, which may lead to gingival attachment loss. Therefore, it is very important to emphasize oral hygiene instructions to orthodontic patients treated with a fixed appliance. It's important for the patients to be motivated and cooperate with those specialists, who will give instructions how to maintain good oral hygiene (2, 3).

However, it would be interesting to study the peculiarities of oral care differences between genders and different age groups, between children and adults with fixed orthodontic appliances.

CONCLUSIONS

1. Most patients aged from 16 to 18 years confirmed that oral hygiene is important for them comparing to the 12-15-year-olds.
2. As a result of assessing the differences between different age groups, it was found that patient aged from 16 to 18 years more often reported brushing their teeth twice a day, three or more times a day compared to the younger patients.
3. Evaluation of the oral hygiene state differences between genders showed that females brush their teeth more regularly than males.
4. Female patients reported to use (every day) interdental brushes more regularly than males, that was statistically significant.

STATEMENT OF CONFLICT OF INTERESTS

All authors declare no conflict of interests.

REFERENCES

1. Almosa NA, Sibai BS, Rejjal OA, Alqahtani N. Enamel demineralization around metal and ceramic brackets: an in vitro study. *Clin Cosmet Investig Dent* 2019;11:37-43.
2. Anuwongnukroh N, Deckkunakorn S, Kanpiputana R. Oral hygiene behavior during fixed orthodontic treatment. *Dentistry* 2017;7(10):1-5.
3. Atassi F, Awartani F. Oral hygiene status among orthodontic patients. *J Contemp Dent Pract* 2010;11(1):1-10.
4. Bevinagidad S, Setty S, Patil A, Thakur S. Estimation and correlation of salivary calcium, phosphorous, alkaline phosphatase, pH, white spot lesions, and oral hygiene status among orthodontic patients. *J Indian Soc Periodontol* 2020;24(2):117-21.
5. Kavaliauskiene A, Smailiene D, Buskiene I, Keriene D. Pain and discomfort perception among patients undergoing orthodontic treatment: results from one month follow-up study. *Stomatologija* 2012;14(4):118-25.
6. Kireilytė M, Masiliūnaitė V, Belickienė V, Žilinskas J, Sakalauskiene Ž. Testing of Lithuanian version of the oral health impact profile-14 among older adults. A Pilot study. *Stomatologija* 2019;21(3):67-71.
7. Krasniqi S, Sejdini M, Stubljarić D, Jukić T, Ihan A, Aliu K, et al. Antimicrobial Effect of Orthodontic Materials on Cariogenic Bacteria *Streptococcus mutans* and *Lactobacillus acidophilus*. *Med Sci Monit Basic Res* 2020;26:510-6.
8. Krupinska-Nanys M, Zarzecka J. An Assessment of oral hygiene in 7-14-year-old children undergoing orthodontic treatment. *J Int Oral Health* 2015;7:6-11.
9. Kudirkaite I, Lopatiene K, Zubiene J, Saldunaite K. Age and gender influence on oral hygiene among adolescents with fixed orthodontic appliance. *Stomatologija* 2016;18(2):61-5.
10. Lapenaite E, Lopatiene K, Ragauskaitė A. Prevention and treatment of white spot lesions during and after orthodontic treatment: A systematic literature review. *Stomatologija* 2016;18:3-8.
11. Levrinia L, Posimo D, Tieghi G, Gualandi G, Caprioglio A. Halitosis with fixed orthodontic appliance vs removable orthodontic aligners: preliminary results. *Toma EDUJ* 2016;3(1):90-4.
12. Nagarajappa, Ramesh G, Sandesh N, Lingasha RT, Hussain MAZ. Impact of fixed orthodontic appliance on quality of life among adolescents in India. *J Clin Exp Dent* 2014;6:389-94.
13. Madléna M, Vitalyos G, Márton S, Nagy G. Effect of chlorhexidine varnish on bacterial levels in plaque and saliva during orthodontic treatment. *J Clin Dent* 2000;11(2):42-6.
14. Maheshwari S, Tariq M, Gaur A, Jiju M. A Systematic nutritional and dietary guideline for orthodontic and orthognathic surgery patients. *Indian J Orthod Dentofac Res* 2017;3(3):136-40.
15. Mazin H, Ali S, Salah R. The Effect of fixed orthodontic appliances on gingival health. *J Dent Med Sci* 2016;15(11):82-8.
16. Smolyar NI, Fedoriv JaM, Zavojko LM, et al. Methodological recommendations on statistics. 1995;11(2):17.
17. Silveira S, Valério P. The Increased prevalence of malocclusion in modern humans: an integrative review. *EC Dental Sci* 2018;12(17):2097-107.
18. Smolyar N, Chukhray N, Lesitskij M, Mashkarynets O. Enamel resistance of the permanent teeth in children with different psycho-emotional state. *Stomatologija* 2019;98(6):112-7.
19. Smolyar N, Lesitskiy M, Bezvushko E, Fur N, Hordon-Zhura H. Enamel resistance in children with malocclusions. *Georgian Med News* 2020;(306):37-40.
20. Tuncer C, Canigur Bavbek N, Balos Tuncer B, Ayhan Bani A, Çelik B. How do patients and parents decide for orthodontic treatment-effects of malocclusion, personal expectations, education and media. *J Clin Pediatr Dent* 2015;39(4):392-9.

Received: 17 03 2021

Accepted for publishing: 21 03 2022