

RESEARCH ARTICLE

Clinical Study on the Perception of Patients with Orthodontic Appliances Regarding the Periodontal Change

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Introduction: The orthodontic treatment helps in reestablishing a functional occlusion, improving the aesthetics and functionality of the dento-facial complex. A correct alignment of the teeth, through the correction of some dental or skeletal anomalies, enhances the possibilities of dental hygiene, thus reducing the risk of periodontal affections. Nevertheless, the presence of orthodontic appliances in the oral cavity may reduce the efficacy of the means of oral hygiene by creating retentive areas for food, thus producing damages at the level of the marginal periodontium. **Objective:** The evaluation of oral hygiene practices for patients in the course of fixed orthodontic therapy and the identification of changes appeared at the level of the marginal periodontium caused by the orthodontic appliances.

Material and methods: A questionnaire with 20 questions was distributed to a number of 129 patients undergoing the active phase of orthodontic treatment in the Orthodontic and Dentofacial Clinic of the Medical Dental School Tîrgu Mureş or in some private practices in the Bucharest metropolitan area. **Results:** The majority of patients surveyed are aware of the means of dental hygiene and practice a daily brushing, associated with auxiliary means. The iatrogenic effects of the fixed therapy are represented by gingival recession, gingival overgrowth and bleeding during brushing but these were visible only in the case of a small number of patients. **Conclusions:** The fixed orthodontic treatment must be started only after a thorough evaluation of the marginal periodontium, with a close orthodontist – periodontist collaboration and avoidance of jiggling-like movements.

Keywords: questionnaire, orthodontic appliances, marginal periodontium

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Introduction

Numerous studies prove the interrelation between orthodontic treatment and periodontal treatment at the level of the oral cavity. A correct alignment of the teeth and an adequate interarcadial relation help in improving the facial aesthetics or the masticatory efficacy. This enhances the health of the entire organism, thus raising the quality of life. A correct alignment of the teeth, through the correction of dental or skeletal anomalies, multiplies the possibilities for dental hygiene, thus reducing the risk of periodontal diseases [1, 2].

The orthodontic treatment helps to reestablish the functional occlusion, improving the aesthetics and the functionality of the dental-facial complex. It is well known that the dental malocclusion represent a contributing factor for the appearance of periodontal disease [3]. This comes in the third place regarding the pathology of the oral cavity. By correcting certain dental malpositions such as crowdings, diastemata, or proclinations, the risk of periodontal affection is reduced by relieving the oral hygiene and by directing the occlusal forces in the tooth's ax, thus ensuring their uniform distribution [4].

Considering all this, the presence of orthodontic appliances in the oral cavity may lead to the decrease of the

means of oral hygiene by creating several retentive areas for food. Furthermore, the application of orthodontic appliances leads to the appearance of additional surfaces in the oral cavity, with different properties as compared to those of the natural oral surfaces. These contribute to the development of the biofilm and to the multiplication of cariogenic and periodontopathogenic bacteria [5]. Sometimes, the components of orthodontic appliances may produce lesions at the level of oral mucosa. Frequently, these lesions are located in the lingual or oral mucosa, or respectively in the retromolar area, where the lesion is produced by the extension of the arc towards the distal area. The lesion of the oral epithelium leads to the exposure of nerve endings, producing a sensation of pain and discomfort. The pain appears at an interval of approximately 24 hours from the moment of the lesion. In the absence of infections, the ulceration disappears in an interval of 12-14 days from the removal of the causal agent [6].

Thus, a rigorous oral hygiene is essential in maintaining an adequate periodontal status. Apart from the brushing frequency, an important role is played by the type of dental brushing, the patient's dexterity, and the adjunctive oral hygiene aids recommended by the specialist doctor (e.g., interdental brushes, mouthwash, dental floss). These need to be individually adapted based on the patient's dexterity, her motivation, or her predisposition to developing dental or periodontal affections. Together with accepting the or-

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thodontic treatment, the patient needs to be conscious of the importance of oral hygiene and of the changes brought by the dental hygiene practices.

The aim of this study is to evaluate the oral hygiene practices of patients in the course of fixed orthodontic therapy and to identify the changes that appear at the level of the marginal periodontium caused by these orthodontic appliances.

Material and methods

A questionnaire with 20 questions was distributed to a number of 129 patients undergoing the active phase of the orthodontic treatment in the Orthodontic and Dentofacial Clinic of the Medical Dental School Tîrgu Mureş or in some private practices in the Bucharest metropolitan area. All patients included in the study are over the age of 13 and are undergoing fixed orthodontic treatment. The questionnaire was distributed during January – March 2019.

The questionnaire contains closed-answer multiple choice questions. The questionnaire is self-developed, with multiple choice options, phrased concisely and for the easy understanding of each patient. It was filled in the waiting room, in the presence of an examiner that was available to answer any unclarities regarding the questions. The time required to fill in a questionnaire was approximately 2 minutes.

The questionnaire is anonymous and contains questions structured in 4 parts. The first 5 questions (1-5) focus on the demographics and treatment period details. The following 6 questions evaluate the hygiene put in place by patients, the brushing methods and the time allocated for brushing (6-11). The following 4 questions (12-15) contain information about the adjunctive oral hygiene aids used, the frequency with which these are used, with the role of observing the patients' compliance and the doctor's attitude in what regards them informing patients about the existence of such adjunctive methods. The last 5 questions (16-20) refer to the changes which appeared at the level of the marginal periodontium following the application of orthodontic devices.

Informed consent was obtained from all patients or from their parents/guardians.

The obtained results were analysed statistically using the Chi square test.

Results

129 patients were surveyed, 73 of which were women. The 13-17 years old segment represents 43% of all patients, 32% of patients being in the 18-25 years old segment, while 26% of them are over 25 years old. The majority of patients comes from the urban areas (64%). The majority of patients (45%) had been undergoing treatment for 6-12 months, 33% of patients were at the beginning of the orthodontic treatment (below 6 months), while 19% of patients had been undergoing treatment for longer than 1 year.

There is a statistically significant correlation between the area of residence (urban / rural) and the type of dental clinic visited. Thus, only 12% of patients coming from urban areas chose to follow a treatment in a state clinic, while 28% of patients in the rural area selected such clinics (p value : 0.0422)

The manual toothbrush is the most used method of oral hygiene (58.59%), while 23.44% of patients use the electric toothbrush, and 17.97% use both types of brushes. Furthermore, 11% of patients coming from rural areas use the electric toothbrush as compared to 39% of patients from urban areas (p value : 0.0014). Regarding the softness of the brush used, the most prevalent type is the soft bristles toothbrush (35%), ultra soft bristles (29%), or medium bristles (34%), while hard bristles are only used in 3% of cases. Female patients are mostly using manual toothbrushes with ultra soft bristles (39%), while male patients use the toothbrush with soft bristles (37%) (p value: 0.0238).

Fig. 1 presents the methods of brushing used by the patients. They generally undergo a vertical brushing (55%), or a combined style of brushing (24%).

Only 5% of patients have not noticed any changes in the habits of oral hygiene (changes in the duration or frequency). 53% of patients observed both increases in the frequency and in the duration of the brushing, 30% observed increases in the duration of the brushing, while 12% observed increases in the frequency of brushing. The

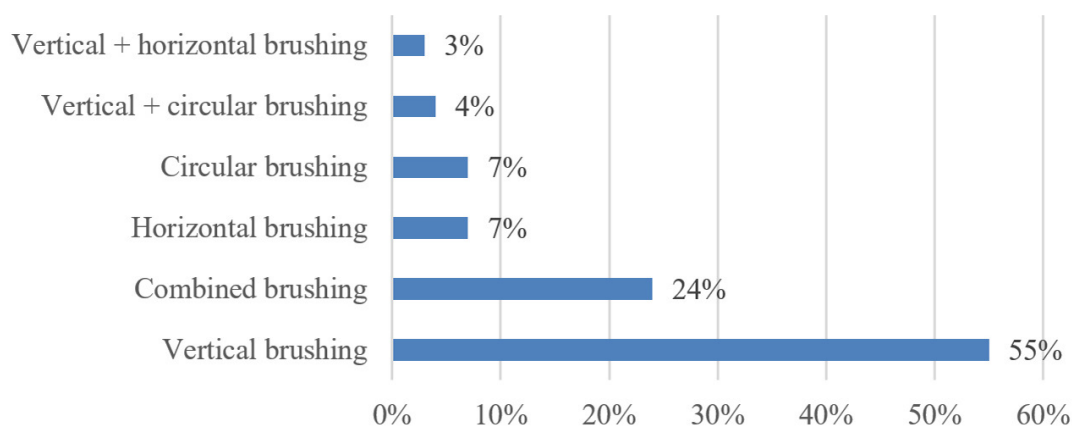


Fig 1. Distribution of patients by type of brushing

majority of patients undergo a regular brushing, 2 or more times per day (45% and 48%, respectively), a significantly higher percentage compared to the patients who undergo a 3-5 min long brushing (57%). Female patients brush 3 or more times per day (61%), while male patients predominantly brush 2 times per day (55%) (p: 0.0044). (Fig.2)

Concerning the awareness on the adjunctive oral hygiene aids, the majority of patients (91%) were informed regarding their use, 2% declared they were not informed, while 6% answered inconclusively „I don't know". The frequency of use of the adjunctive oral hygiene aids is represented in Table I.

We also observed a statistically significant correlation between use of mouthwash and the patients' age. The 13-18 years segment mouthwash is used 2 times per day (43%), while the rate of heavy users is decreasing significantly with the increase in age (p: 0.0474).

The frequency of gingival changes induced by the presence of orthodontic appliances is represented in Table II. 10% of patients did not observe any change in terms of gingival bleeding as compared to the period prior to the start of the orthodontic treatment.

Discussions

The periodontal status of the patients undergoing orthodontic treatment present an interest for both the orthodontist and the periodontist. Any misbalance that appears at the periodontal level is felt by the patient either through bleeding, tumefaction, changes in the gingival appearance, or sensitivity at contact with different stimuli. These can be perceived either as discomfort or can create significant pain which demotivates the patient or may compromise the entire treatment.

In our study, the patients were relatively uniformly distributed by gender (73 women and 56 men), with the

majority coming from urban areas (64.34%). The patients from rural areas prefer to undergo treatments in state clinics in a higher rate (28%) as compared to urban area patients who prefer private clinics (88%) (p: 0.04).

For a more efficient removal of dental plaque, several manual or electric devices were created that, used together with antibacterial substances offer favorable results in reducing gingivitis. Numerous studies compare the efficiency of the manual brush compared to the electric one, yielding mixed results. A single study demonstrated a better efficiency of the manual brush in removing dental plaque as compared to the electric brush [7].

Other authors, on the other hand, did not find a difference between the efficacy of the two types of brushes [8,9]. Of all patients included in our study, 58.59% use the manual toothbrush as the main method of oral hygiene, using a vertical brushing (55%) or a combination of the vertical, horizontal, and circular movements (24%). The electric toothbrush is used to a lower extent (24.44%) while an even lower number of patients use both types of brushes alternatively (18%). We also observed the fact that the electric toothbrush is used more by patients from urban areas (p: 0.0014). Very few patients from rural areas (19%) use the electric toothbrush, probably due to the more difficult access to new technologies and a weaker purchasing power compared to the urban areas. The patients included in our study are well informed regarding the consistency of the manual toothbrush and its efficacy. Only 3% of patients use the manual toothbrush with hard bristles. The ultra soft bristles toothbrush is used in particular to obtain a finesse brushing of the gingival sulcus or in case of a high dental sensitivity. This brush is used by the patients in the study in a lower rate (29%) and is used particularly by female patients (39%) vs. male patients (14%) (p: 0.0238). Using supporting oral hygiene methods, such as toothbrushes

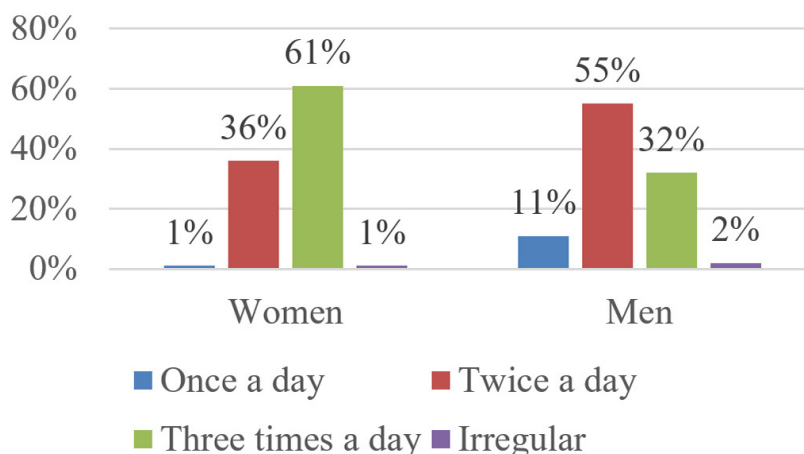


Fig 2. Correlation between gender and brushing frequency

Table I. Frequency of using auxiliary oral hygiene methods

	Once / day	Twice / day	3 times / day	Never	Total
Mouthwash	45%	34%	9%	12%	n:128
Interdental brush	40%	34%	18%	8%	n: 128
Super Floss	45%	13%	5%	37%	n:129

Table II. Frequency of changes appeared at gingival level

	Yes	No	I don't know
Bleeding (n:116)	16%	63%	11%
Gingival overgrowth (n:129)	12%	66%	22%
Sensitivity (n:129)	46%	46%	8%
Ulcerations (n:129)	23%	62%	15%
Gingival recession (n:129)	4%	65%	31%

dedicated for patients with fixed orthodontic appliances, can lead to an increase in the brushing time as compared to the time allocated for brushing before the beginning of treatment. The patients surveyed for this study observed a change in the methods of oral hygiene. The majority has observed an increase in the time allocated for brushing, but also an increase in the frequency. Female patients showed a higher interest for oral hygiene ($p: 0.0044$), brushing 3 or more times a day (61%) as compared to male patients who brush twice per day (55%).

In our study, we noticed a more frequent use of adjunctive oral hygiene aids. The interdental brush was the most used method of auxiliary hygiene (91.40%), used predominantly once (40%) or twice per day (33.60%). The mouthwash is used by 87.5% of patients, mostly once per day (44.5%). The super floss is the least used method of auxiliary hygiene (63%), but also holds a rather high frequency. A similar study undertaken in India on a lot of 40 patients aged 18-30 years old, shows that 2% of patients use super floss, while 7% of them use interdental brushes. 42% of patients use mouthwash with 24% of them doing it once per day and 18% twice per day [10]. Also in India, Mayuresh J Baheti and his collaborators, in a study on 150 patients aged 13-20 [11], observed a use of interdental brush for 22.60% of patients, while mouthwash was used by 31.33%. Similar results were obtained in a study undertaken by Priscila Ariede and collaborators in Brasil, where 11.11% of the 27 volunteers included in the study use super floss and interdental brushes [12].

The different results of the three studies compared to our results is probably due to the significantly different social and/or economic status of the countries involved in the study. In our work, we observed a correlation between patients' age and use of mouthwash. The majority of patients use mouthwash (87.5%), particularly in the 13-17 years old segment, who use mouthwash two or more times a day. Once the age increases, the use of mouthwash decreases significantly ($p: 0.047$).

The number of patients who observed the appearance of a dental sensitivity is almost equal to the number of patients who did not observe something similar (60 and 59 patients, respectively). Although the dental sensitivity has been reported by almost half of the patients, very few noticed the appearance of gingival recession (only 5 patients did, while 40 patients responded inconclusively). In this case, the dental sensitivity may be induced by stripping, a method used to create space in order to avoid extractions. Furthermore, 80% of patients who denied the appearance of gingival recessions are 13-17 years old, with the possibility that the presence of a gingival recession may not have been correctly appreciated.

In the study conducted by Mayuresh J Baheti and collaborators [11] 52.77% of patients did not notice any change at the gingival level, considering it in a good state. 34.16% of patients classify the gum as being in a good state, while 13.05% of them consider it is in a state of suf-

fering since the beginning of the orthodontic treatment. These parameters were also evaluated by Azaripour A and collaborators [13]. The gingival changes that refer to tumefaction, bleeding and changes in the colour of the gum are comprised into one question, to which 56% of patients responded affirmatively. In our study, 62.79% of patients denied the appearance of gingival bleeding, while 10% of them did not notice any change in the gingival bleeding as compared to the period prior to the orthodontic treatment.

Although the increases in the gingival volume often represent an iatrogenic effect of the fixed orthodontic treatment, only 12% of patients included in this study noticed the presence of gingival hiperplasia / hypertrophy. The increases in the gingival volume most often appear in cases of patients with precarious hygiene or in cases of prolonged orthodontic therapy [14]. The low frequency of the gingival volume increases noticed by patients included in our study is due to the correct hygiene practiced and to the short period of orthodontic treatment, which exceeds 24 months only in the case of 19% patients.

In our study, a relatively small number of patients signaled the appearance of ulcerations in the oral mucosa (24% answering affirmatively, 15% answering inconclusively), as compared to other studies in which patients signaled the presence of ulcerations to a higher degree. 95% of patients surveyed by Kvam E and collaborators observed ulcerations in the oral mucosa [15]. However, 83% of them labeled this inconvenience as a minor one. In order to prevent the appearance of ulcerations, the curating doctors of the patients included in this study recommend the use of protective wax in the respective areas.

Conclusions

1. The orthodontic therapy of adult patients will start after the evaluation of the periodontal status, while for patients that have suffered from periodontal issues, an antiinflammatory therapy and a new evaluation of periodontal indices PI (plaque index), BOP (bleeding on probing), CAL (clinical attachment level) is recommended before the application of the fixed orthodontic appliance.
2. The majority of surveyed patients are aware of the dental hygiene methods and use a daily vertical brushing, associated with adjunctive oral hygiene aids, for around 3-5 minutes.
3. Female patients brush more frequently, 3 or more times per day, as compared to male patients that brush around 2 times per day.
4. The iatrogenic effects of the fixed therapy for adult patients are represented by the gingival recession, bleeding during brushing and hyperplasia, but these were only present for a small number of patients.
5. The gingival recession and hyperplasia are destructive processes that may also appear in the absence of orthodontic treatment, which makes the anamnesis

important in signaling risks factors prior to applying orthodontic forces.

6. The fixed orthodontic treatment for adults must be instituted only after the rigorous evaluation of the marginal periodontium, with a close orthodontist – periodontist collaboration, and by avoiding the jiggling-like movements (that overstress the mucogingival junction).

Abbreviations

PI- Plaque index

BOP- Bleeding on probing

CAL- Clinical attachment level

Conflict of interest

None to declare.

Authors' contribution

Simina Chelărescu (Conceptualization; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Writing – original draft)

Karina Dombi (Data curation)

Oana Gânsă (Data curation)

Panainte Irinel (Funding acquisition)

Olteanu Cristian (Software)

Mariana Păcurar (Supervision; Validation; Visualization; Writing – review & editing)

References

1. Boke F, Gazioglu C, Akkaya S, et al - Relationship between orthodontic treatment and gingival health: A retrospective study. *Eur J Dent.* 2014;8:373–380
2. Alfurji S, Alhazmi N, Alhamlan N, et al - The Effect of Orthodontic Therapy on Periodontal Health: A Review of the Literature. *Int J D.* 2014;2014:1-8
3. Berndardt O, Krey KF, Daboul A, et al - New insights in the link between malocclusion and periodontal disease. *J Clin Periodontol.* 2019;46:144-159
4. Gusmao ES, Coutinho de Queiroz RD, Coelho RS, et al - Association between malpositioned teeth and periodontal disease. *Dental Press J Orthod.* 2011;16:87-94
5. Ren Y, Marije A, Li Mei, et al - Orthodontic treatment with fixes appliances and biofilm formation-a potential publichealth threat? *Clin Oral Invest.* 2014;18:1711-1718
6. Lauren A, Rennick, Campbell PM, et al - Effectiveness of a novel topical powder on the treatment of traumatic oral ulcers in orthodontic patients: A randomized controlled trial. *Angle Orthod.* 2016;86:351-357
7. Trimpeneers LM, Wijgaerts IA, Grognaard NA, et al - Effect of electric toothbrushes versus manual toothbrushes on removal of plaque and periodontal status during orthodontic treatment. *Am J Orthod Dentofacial Orthop.* 1997;111:492–497
8. Heintze SD, Brinkmann PG, Loundos J - Effectiveness of three different types of electric toothbrushes compared with a manual technique in orthodontic patients. *Am J Orthod Dentofacial Orthop.* 1996;110:630–638
9. Borutta A, Pala E, Fischer T - Effectiveness of a powered tooth brush compared with a manual toothbrush for orthodontic patients with fixed appliances. *J Clin Dent.* 2002;13:131–137
10. Pandey V, Chandra S, Kumar HP, et al - Impact of dental neglect score on oral health among patients receiving fixed orthodontic treatment: A cross-sectional study. *J Int Soc Prev Community Dent.* 2016;6:120–124
11. Mayuresh J Baheti, Toshniwal NG - Survey on oral hygiene protocols among orthodontic correction-seeking individuals. *J Educ Ethics Dent.* 2015;5:8-13
12. Bardal PA, Kaneshiro KP, Bastos JR, et al - Education and motivation in oral health - preventing disease and promoting health in patients undergoing orthodontic treatment. *Dental Press J Orthod.* 2011;16:95-102
13. Azaripour A, Weusmann J, Mahmoodi B, et al - Braces versus Invisalign: gingival parameters and patients' satisfaction during treatment: a cross-sectional study. *BMC Oral Health.* 2015;15:69
14. Pinto AS, Alves LS, Zenker JEDA, et al - Gingival enlargement in orthodontic patients. Effect of treatment duration. *Am J Orthod Dentofacial Orthop.* 2017;152:477-482
15. Kvam E, Bondevik O, Gjerdet NR - Traumatic ulcers and pain in adults during orthodontic treatment. *Community Dent Oral Epidemiol.* 1989;17:154-157

Appendix - Questionnaire

Perception of patients with orthodontic appliances regarding the periodontal changes

1. Age
 - a. 13-18 years
 - b. 18-25 years
 - c. > 25 years
2. Gender
 - a. Female
 - b. Male
3. Background
 - a. Urban
 - b. Rural
4. Type of dental clinic
 - a. Private dental clinic
 - b. Public dental clinic
5. When did you start the orthodontic treatment?
 - a. < 6 months ago
 - b. 6-12 months ago
 - c. > 12 months ago
6. What type of toothbrush do you use?
 - a. Manual
 - b. Electric
 - c. Both
7. What type of bristles do you use?
 - a. Extra soft
 - b. Soft
 - c. Medium
 - d. Hard

8. What is your brushing technique?
- Vertical
 - Horizontal
 - Circular
 - Combined
9. How did the orthodontic treatment interfere with the oral hygiene habits?
- Increase in toothbrushing time
 - Increase in toothbrushing frequency
 - Both of the above mentioned
 - It did not influence me
10. How often do you brush your teeth?
- Once daily
 - Twice daily
 - Three times a day or more
 - Irregular
11. How long do you brush your teeth for?
- 1-2 minutes
 - 3-5 minutes
 - 5-10 minutes
 - Over 10 minutes
12. Have you been informed about adjunctive oral hygiene aids and how to use them?
- Yes
 - No
 - Not sure
13. Do you use mouthwash?
- Once daily
 - Twice daily
 - More than twice daily
 - Never
14. Do you use interdental toothbrush?
- Once daily
 - Twice daily
 - More than twice daily
 - Never
15. Do you use dental floss?
- Once daily
 - Twice daily
 - More than twice daily
 - Never
16. Has the orthodontic treatment resulted in gingival bleeding?
- Yes
 - No
 - Not sure
 - No change
17. Has the orthodontic treatment resulted in gingival enlargement?
- Yes
 - No
 - Not sure
18. Has the orthodontic treatment resulted in tooth sensitivity?
- Yes
 - No
 - Not sure
19. Have you noticed gingival recession? (change in the position of the gums, in the opposite direction of the tooth)?
- Yes
 - No
 - Not sure
20. Has the orthodontic treatment resulted in painful lesions?
- Yes
 - No
 - Not sure