

RETROSPECTIVE STUDY REGARDING THE STATUS OF THE SUPERFICIAL MARGINAL PERIODONTIUM IN ADULT PATIENTS WEARING ORTHODONTIC RETAINERS

Sorana Maria Bucur¹, Cristina Raffanini Chiarati¹, Paola Avino², Ilaria Migliorino², Dorin Ioan Cocos¹, Eugen Silviu Bud^{2*}, Anamaria Bud^{2*}, Alexandru Vlasa²

¹“Dimitrie Cantemir” University, Faculty of Medicine, Târgu Mureș, Romania

²“George Emil Palade” University of Medicine, Pharmacy, Science and Technology, Târgu Mureș, Romania

* Corresponding authors: Eugen Silviu Bud, e-mail: Eugen.bud@umfst.ro

Anamaria Bud, e-mail: Anamaria.bud@umfst.ro

ABSTRACT

Aim of the study: Retention is an important and necessary step at the end of orthodontic treatments. Unfortunately, periodontal inflammation and gingival retraction due to plaque deposits are more difficult to control in case of orthodontic retainers' wearers. **Material and method:** Our study was performed on 87 adult patients with various orthodontic retainers. To quantitatively determine the accumulation of dental plaque we used the Oral Simplified Hygiene Index OHI-S, the Quingley-Hein plaque index modified by Turesky and the Navy plaque index modified by Rustogi. Another studied parameter was the gingival recession. **Results:** The results showed that periodontal problems occurred most often in case of male patients wearing fixed retainers and plaque accumulation is smaller in mobile retainer wearers; the exception was for the Hawley plate, where the accumulation of interdental plaque was higher than in all the other studied retainers. **Conclusions:** Periodontal damage occurs most often in case of male patients wearing a fixed retainer, the use of Hawley plate resulted in the highest accumulation of interdental plaque of all studied retainers.

Key Words: orthodontic retainer, gingival recession, periodontal disease

INTRODUCTION

Periodontal disease is an inflammation that affects the supporting tissue of the tooth. Its loss is closely linked to inflammation and is influenced by infections and interactions among microorganisms. Thus, the main and determining role of microbial factor in the production of periodontal disease is currently supported [1].

The periodontal disease affects one or more of the four components of the tooth support system: gums, alveolar bone, periodontal

ligaments and cement thus defining a chronic destructive and progressive inflammatory process. [2,3].

For a better understanding of periodontitis, the Department of Periodontology in Bucharest proposes the following classification [4]:

1. Gingivitis induced by specific bacterial plaque;
2. Gingivitis induced by specific bacterial plaque and the contribution of local and general factors;

3. Gingivitis not induced by specific bacterial plaque;
4. Aggressive periodontitis;
5. Chronic marginal periodontitis;
6. Periodontitis as a manifestation of a systemic disease;
7. Ulcerative-necrotic gingivitis / periodontitis.

In addition to bacterial plaque which is the main factor responsible for the occurrence of periodontal disease there are other irritant factors for the periodontal tissues such as tartar, incorrectly adapted fillings, overflowing prosthetic works, orthodontic braces, orthodontic retention devices, etc. [4].

Retention after wearing a fixed orthodontic appliance is the final stage of the orthodontic treatment. Without retention the results obtained would not be stable in time, therefore it is necessary to give it a very high attention [5]. Contention after the orthodontic appliance has been recommended by a lot of researchers and authors [6-8]. Adequate contention is needed primarily to allow the dento-alveolar and supra-crestal ligaments to reorganize and allow the new bone reshaping. Artificial retention can be done with Hawley (HR)-mobile plates, removable vacuum-formed retainers (VFR), fixed oral retainers and functional devices [6-8].

The Hawley mobile plate, imagined by Charles Hawley in 1920 proved effective because it causes minor dental movements necessary to close spaces after removing the orthodontic rings [9]. In 1971 a transparent retainer (VFR) was imagined as a much more aesthetic method [7,10,11]. In addition to the aesthetic aspect VFR have other advantages: cheap and easy to make, accessible replacement if fractured or deteriorated; much more accepted by patients because they do not cause vomiting reflex by not covering the palate; a minimum occlusal thickness that prevents occlusion elevations; they do not

cause irritation to the gums because they end above the gingival margin [10].

In 1964 Green and Vermillion designed a simplified version of the oral hygiene index OHI in which the presence of bacterial plaque and oral tartar is examined on 6 teeth instead of 12 [12]: 11, 16, 26 – buccal surfaces and 31, 36, 46 – oral surfaces and it is a sum of DI-S (debris index simplified) and CI-S (calculus index simplified). Debris index calculation method: 0 = absence of dental plaque; 1 = microbial plaque present up to 1/3 of the tooth surface; 2 = microbial plaque present between 1/3 and 2/3 of the tooth surface; 3 = microbial plaque present over 2/3 of the tooth surface. Tartar or calculus index calculation method: 0 = absence of dental tartar; 1 = tartar present up to 1/3 of the tooth surface; 2 = tartar present between 1/3 and 2/3 of the tooth surface; 3 = tartar present over 2/3 of the tooth surface. The averages for the plaque and tartar indices will be calculated and then added together; their sum will represent the OHI-S index. Index interpretation: excellent 0; good 0.1-1.2; satisfactory 1.3-3.0; unsatisfactory 3.1-6 [13].

The Quingley-Hein plaque index modified by Turesky has a high sensitivity for changes in oral hygiene [14,15]. To determine this index all teeth except the wisdom ones will be examined. The bacterial plaque will be highlighted in both buccal and oral areas, the maximum number of inspected surfaces will be 56. The average Quingley-Hein index, modified by Turesky will be the total number of points for each tooth / total number of examined areas. Score will be: 0 = absence of bacterial plaque (BP); 1 = BP as a dashed line at the cervical level; 2 = BP as a continuous line at the cervical level, <1mm; 3 = continuous line of BP exceeding 1 mm but not more than 1/3; 4 = BP between 1/3 and 2/3 of the surface; 5 = BP exceeding more than 2/3 of the surface. Interpretation of the index: <0-1 - excellent hygiene; <1-2 - good

hygiene; <2-3 - moderate hygiene; <3-4 - poor hygiene; <4-5 - absent hygiene [14,15].

In the case of Navy plaque index modified by Rustogi [16] the tooth's surface is divided into 9 zones on vestibular and oral areas, a total of 18 zones, the wisdom teeth being excluded. If the plaque is not present on any of the 18 zones then the score is 0; if the plaque is present on any of the zones the score of the affected area is noted by 1. For a single tooth the index is determined as follows: index per tooth = sum of all areas marked with 1/18. Average at the level of an arcade = the sum of the indices obtained for each tooth / number of teeth. Results are between 0 and 1 with 0 for excellent hygiene and 1 for absent hygiene.

The purpose of this retrospective study was to assess and quantify the impact of orthodontic retainers on superficial periodontal tissue in accordance with a number of variables like patient's sex, periodontal hygiene indices, gingival recession, orthodontic retention device which finally helped to identify the least harmful means of retention for periodontal health.

Gingival recession is defined as the displacement of the apical free gingival margin from the enamel-cement junction. Orthodontic treatment or the following orthodontic retainers may cause the development of gingival recession [17].

The studied hypotheses were:

- orthodontic contention negatively influences the periodontal health;
- fixed retainers cause more periodontal problems than movable retainers;
- periodontal involvement in case of orthodontic retention differs depending on gender.

MATERIAL AND METHOD

The study was performed on a group of 87 patients aged between 20 and 27 years who wore a fixed orthodontic appliance for a minimum period of less than 1 year and a maximum duration of more than 2 years. The group consisted of 33 men and 54 women, mean age 23.4 years old.

With the aid of dental mirrors, periodontal Williams probes and the plaque disclosing tablets (figure 1) clinical examination of the patients was performed in order to determine the following periodontal indices: the simplified dental hygiene index - Oral Hygiene Index-Simplified (OHI-S) - Greene-Vermillion, Quigley-Hein plaque index modified by Turesky and Navy plaque index modified by Rustogi. In case of Navy plaque index modified by Rustogi we marked with A,B,C the gumline tooth zones and with D,F the interproximal tooth areas. No plaque disclosing tablets were used to determine the OHI-S index, which were used to determine the other two indices.

Gingival recession was determined by lying the tip of the periodontal probe on the gingival margin and reading the gradation at the enamel-cement junction.



Fig.1 Instruments used for clinical examination

After the clinical examination all data were recorded using Microsoft™ Excel statistical analysis software, 2017 edition, statistical analysis software.

RESULTS

According to our analyses male patients in the study group showed (figure 2): 46% inferior fixed retainer wearers, 27% with superior fixed retainer, 18% with both inferior and superior VFR and 9% with only superior VFR.

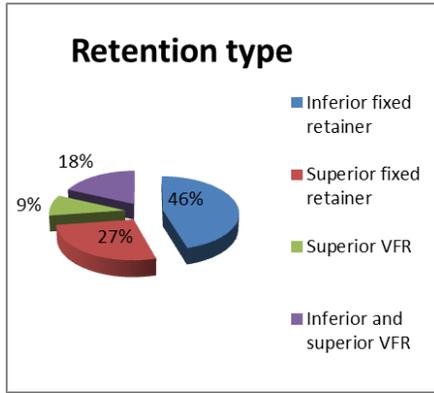


Fig. 2 Male patients' distribution according to retention type

Of the total number of orthodontic retention devices in the study group applied to male patients, the fixed lower retainer was observed in the highest percentage of 46% whilst the lowest percentage was observed in the upper VFR. 64% of the male patients have had at least 1 scaling procedure since the retention was done.

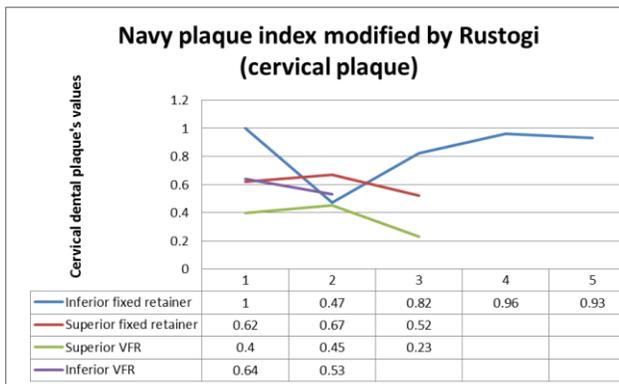


Fig. 3 Cervical plaque, male patients

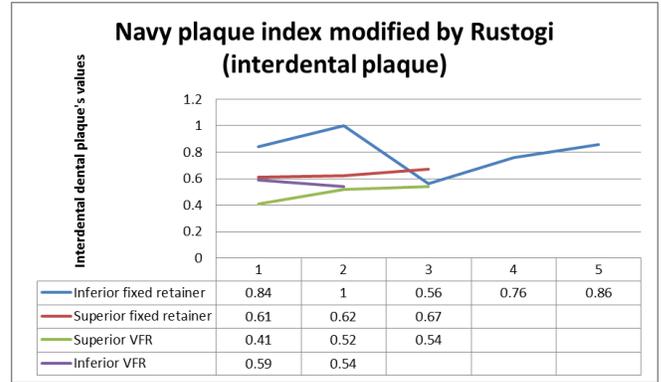


Fig. 4 Interdental plaque, male patients

The highest values of cervical plaque (ABC) were recorded for the lower fixed retainer and the lowest for the upper VFR (figure 3); the highest values of interdental plaque (DF) were obtained for the lower fixed retainer and the lowest in cases with upper VFR (figure 4).

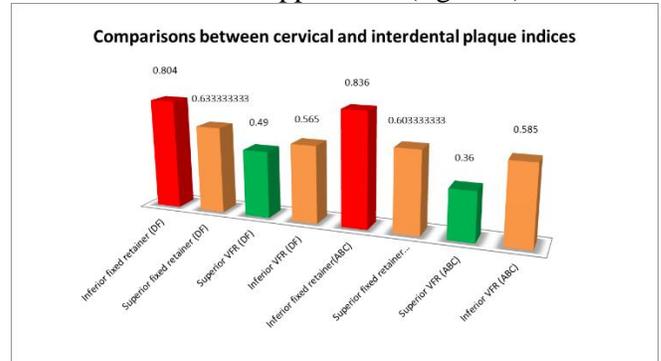


Fig. 5 Comparisons between cervical and interdental plaque indices, male patients DF = interdental; ABC = cervical.

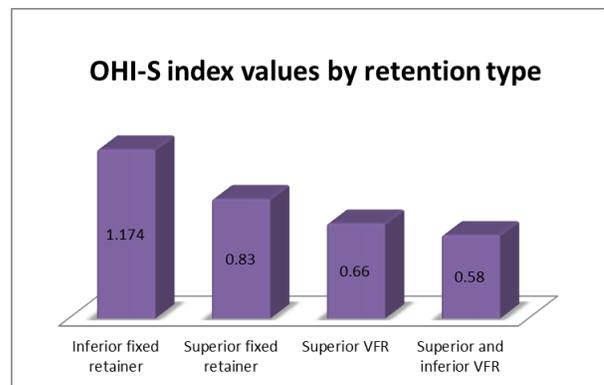


Fig. 6 OHI-S index values, male patients

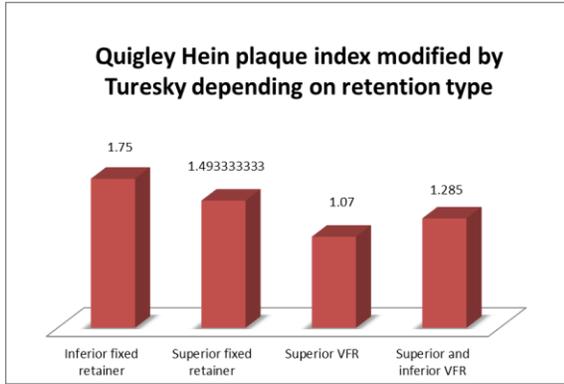


Fig. 7 Quigley-Hein plaque index modified by Turesky, male patients

The highest value in the case of the simplified dental hygiene index OHI-S (1.174) was recorded in male patients with lower retainers (figure 6). The highest value in the case of the Quigley-Hein plaque index modified by Turesky (1.75) was observed in lower retainer’s wearers (figure 7).

Gingival recession measures had values between 1-3 mm. In the male group the highest value of gingival recession (56%) was recorded in those with inferior fixed retainers, followed by cases with superior fixed retainers. The lowest values of gingival recession were determined in groups with inferior and superior VFR, 13% and 10% respectively.

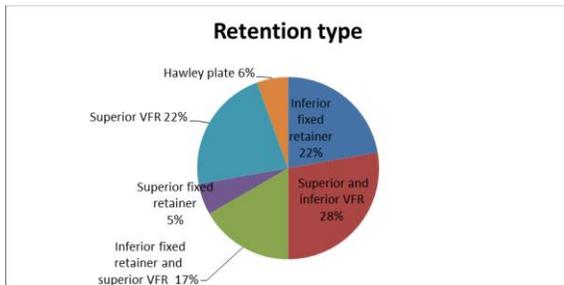


Fig. 8 Female patients’ distribution according to retention type

Of the total number of orthodontic retention devices applied to female patients in the study group the upper and lower VFR applied together were in the highest percentage of

28%, the inferior fixed retainer wearers were 22%, the superior VFR wearers were 22%, the patients with both inferior fixed retainer and inferior VFR were 17% and the lowest percentage was represented by the upper fixed retainer wearers, 5% (figure 7). 50% of the female patients have had at least 1 scaling procedure since the retention device was applied.

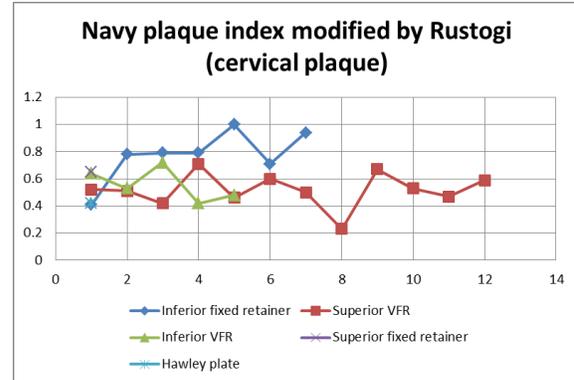


Fig. 9 Cervical plaque, male patients

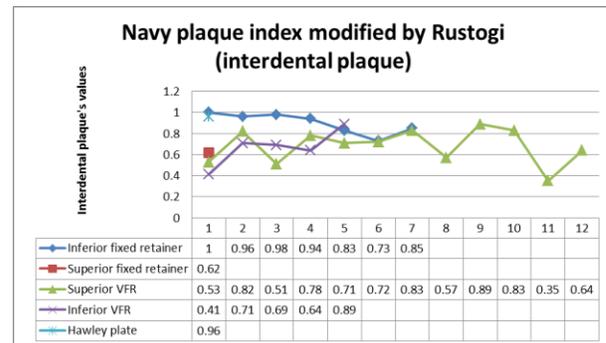


Fig. 10 Interdental plaque, female patients

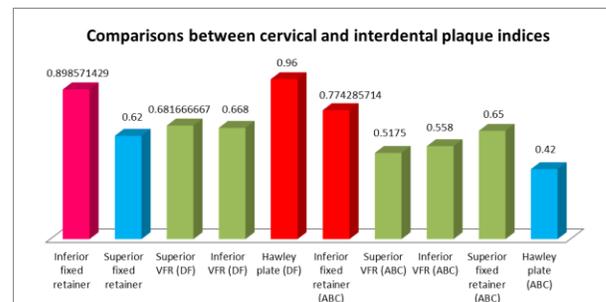


Fig. 11 Comparisons between cervical and interdental plaque indices, female patients. DF = interdental; ABC = cervical.

The highest values of cervical plaque (ABC) were recorded for the lower fixed retainer and the lowest for the upper VFR and the Hawley plate (figure 9). The highest values of interdental plaque (DF) were obtained for the Hawley plate and the lower retainer and the lowest for the upper retainer (figure 10).

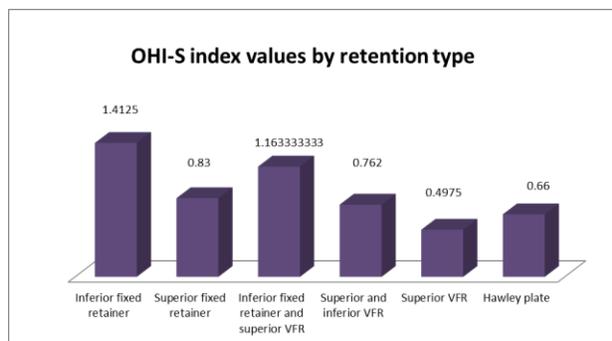


Fig. 12 OHI-S index values, female patients

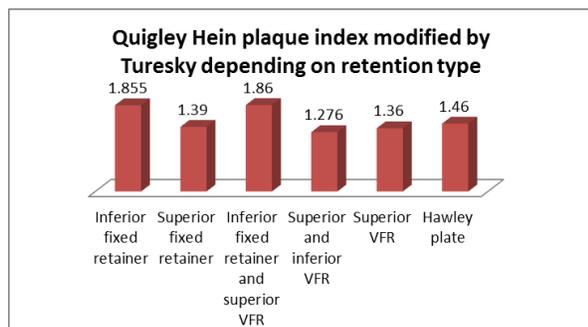


Fig. 13 Quigley-Hein plaque index modified by Turesky

Regarding the simplified dental hygiene index (OHI-S) the highest value was obtained in lower retainer wearers (figure 12). Regarding the Quigley-Hein plaque index modified by Turesky the highest value was observed in

patients with lower fixed retainer and upper VFR (figure 13).

DISCUSSIONS

In the present study an attempt was made to evaluate the negative effects that orthodontic retention devices determine on the marginal periodontium and to specify the most harmful one for the periodontal tissue. Among the negative effects of retainers, the most important is the excessive accumulation of bacterial plaque that leads to gingival recessions with root stripping and the appearance of tooth sensitivity [17]. Our results showed that in case of the male patients it seems that from all devices applied the lower fixed retainer is the most harmful for the marginal periodontium by causing a massive accumulation of bacterial plaque especially in the cervical area (0.836 out of 1 maximum the score of the Navy plaque index, modified by Rustogi), but the accumulation at the interdental level should not either be neglected (0.804).

Our study's results have demonstrated that for female patients the inferior fixed retainer causes an accumulation of bacterial plaque in cervical area of 0.774 which is smaller than in males (0.836) but the accumulation was higher at interdental level, 0.898 even 0.96 in cases with Hawley plate.

The lowest values of bacterial plaque at cervical and interdental level, both in males and females, were obtained by using the upper VFR, with a much lower score in males.

In case of comparisons between plaque indices at cervical and interdental level the biggest difference is observed in Hawley plate; probably the wire anchoring systems favor the more massive plaque deposition at interdental level compared to the cervical area which is much more accessible to self-cleaning. In fact, of all investigated orthodontic retainers the Hawley's plate wearers demonstrated the largest accumulation of interdental plaque.

By inspection and palpation without the application of plaque-revealing tablets the OHI-S index showed that patients with lower fixed retainers have satisfactory hygiene. By using plaque-revealing tablets, the Quingley-Hein index modified by Turesky supported the idea that indeed the lower fixed retainer causes the highest plaque's accumulation of all orthodontic retainers used. A similar study [18] showed that there is more plaque and tartar in patients with fixed retainers. However, patients did not demonstrate gingival inflammation in the same way as patients with mobile retainers. [18]

Regarding gingival recession our study show that in 56% of male patients and 40% of women patients, recession occurs when wearing the lower fixed retainer. Similar data are presented in a study [19] created by the "Third National Health, Nutrition Examination Survey" in which the authors showed that men have a much higher gingival recession and much more tartar accumulation compared to women [19] especially due to a much larger size of their teeth. [20].

Therefore, comparing the two types of orthodontic retention devices, both mobile and fixed ones retainers have advantages and disadvantages. The big advantage of fixed

retainers is that being cemented on teeth the patient is forced to wear it; the disadvantage is that accumulates dental plaque much more than mobile retainers. The vacuum formed retainers have the lowest plaque index score of all contention devices but the disadvantage is the non-compliance of patients who forget to wear it.

CONCLUSIONS

1. Periodontal damage occurs most often in case of male patients wearing a fixed retainer.
2. The oral hygiene of the group with fixed orthodontic retainers was compromised while the hygiene of the group with mobile orthodontic retainers was better.
3. All the investigated plaque indices evaluated showed a high score in the case of fixed retainers.
4. The use of Hawley plate resulted in the highest accumulation of interdental plaque of all studied retainers.
5. Mobile retainers are superior in terms of maintaining oral hygiene, but the use of fixed retainers cannot be waived.

Conflict of interest: the authors declare no conflict of interest associated with this paper.

Institutional Review Board Statement: the study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of SC Algocalm SRL, Târgu-Mures, Romania, 899/01.02.2021.

Informed Consent Statement: informed consent was obtained from all subjects involved in the study

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