

# THE INFLUENCE OF A FIXED ORTHODONTIC RETAINER ON THE DENTO-ALVEOLAR COMPLEX

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## ABSTRACT

**Introduction:** One of the major challenges of orthodontists is the long-term stability of orthodontic treatments. Recent research has shown insufficient high-quality evidence to make recommendations on retention procedures.

**This study aimed** to determine whether the doctors of dental medicine had noticed in their practice the harmful effects of the fixed orthodontic retainer and which effects are the most common.

**Material and methods:** For this research, a questionnaire with 11 questions was made. The questionnaires were distributed to doctors of dental medicine on the territory of the Federation of Bosnia and Herzegovina. A total of 70 doctors of dental medicine participated in this research, 41 of which were general dentists and 29 specialists.

**Results:** Out of the total number of respondents, 90% answered that they had patients with a fixed orthodontic retainer. More than 90% of respondents answered that in patients having fixed retainer, they observed plaque accumulation, 77% observed the presence of calculus, and 73% the occurrence of gingivitis. Smaller percentage were those who noticed the presence of a gingival recession (15, 8%), periodontitis (15, 8%), caries (33, 3%) and teeth rotation (28,6%). The program Spss 23.0 Chicago was used for the statistical analysis.

**Conclusion:** Respondents noticed the harmful effects of a fixed orthodontic retainer on the dentoalveolar complex. The most common harmful effects are increased plaque accumulation, dental calculus and gingivitis.

**Keywords:** retention, orthodontic therapy, fixed retainer

## Introduction

One of the biggest challenges of modern orthodontics is the long-term stability of achieved results. Numerous factors influence the long-term stability of orthodontic therapy results. There are three main reasons why retention is necessary after completed treatment:

- Orthodontic teeth movement affects the gingiva and periodontal tissue requiring some time to reorganize after the removal of apparatus.
- Teeth can be in an unstable position after therapy so the pressure of soft tissue constantly creates a tendency for relapse.
- Changes caused by growth can alter the result of orthodontic therapy [1].

Retention is necessary for all patients having irregularities in dental arch corrected using fixed apparatus [1, 2]. Actual patients have great expectations which could only be fulfilled in the long term run by careful planning from the very beginning of the treatment. The regime of maintaining the state achieved by therapy inevitably requires considerate patients' cooperation being only possible with full patients' information before the treatment and their understanding the therapy plan, as well as, their role during and after the therapy [3, 4].

It is possible to use fixed or mobile retainer as a mean of retention [5]. The type of retention mean depends on the initial diagnosis, patient's age as well as the type of therapy that was applied, but in any case, it should be included in the initial therapy plan.

More recent studies have shown that there is no exact evidence favoring some of the retention means [2] thus the choice of retention apparatus type is frequently the result of the orthodontist's individual preferences [4].

There are cases mentioned in reference literature where a fixed orthodontic retainer is indicated in situations when doctors expect the instability of teeth in an arch and when prolonged retention is planned [1]. The application of fixed orthodontic retainer is primarily recommended in the cases of significant teeth rotations, protrusion of lower mandibular incisors, combined orthodontic-periodontal

therapy, diastemas, non-surgical treatment of the open bite in front [3].

Since the effectiveness of mobile retainers depends on patient's responsibility, fixed retainers are introduced to provide a reliable and successful way to reduce the tendency of relapse [5]. The advantage of fixed orthodontic retainer application is reflected in the fact that the success of therapy does not depend on the cooperation with the patient, and the flexibility of interproximal wire parts enables slight teeth movements occurring as a result of occlusal force activity.

Disadvantages of fixed orthodontic retainer include difficult oral hygiene maintenance, retention surfaces for dental plaque, as well as, the possibility of the occurrence of decalcification and caries lesions [3].

Some studies researched the effects that fixed lingual retainer bonded canine to canine had on oral health [5]. The retainers were inspected after 3 years [6], after at least 9 years [7], after at least 20 years from the retainer installation [8]. The results of these studies showed that long-term retention of lower incisors using a fixed retainer did not harm teeth and periodontal health, accompanied by good oral hygiene. Additionally, the results showed that it is possible to maintain good periodontal hygiene and health with fixed retainers previously educating the patient on the proper techniques for oral hygiene maintenance [8].

On the other hand, some researches confirm the harmful effects of the fixed orthodontic retainer, as well as, their connection to the increased frequency of recidivism, plaque retention and gingival bleeding after sounding. In their study, Leniv and associates examined the relation between orthodontic treatment, fixed retainers, and gingival health, and the results showed that orthodontic treatment, especially in combination with the fixed orthodontic retainer, can harm periodontal health. That is why good oral hygiene and regular checkups during and after therapy are recommended [9].

Although the effect of fixed retainers on the periodontal teeth status is extensively clinically examined, the results of the majority of studies are still inconsistent.

## The aim

This research aimed to examine the effect of fixed retainer on dento-alveolar complex condition. Along with this main aim, the additional aim was to determine the most common harmful effects of a fixed retainer if any exists.

## Materials and methods

Doctors of dental medicine from the territory of entire Bosnia and Herzegovina took part in this research. Part of the participants are employed in public health institutions (health centers, Faculty of Dental Medicine Sarajevo), and part in private health practices. Doctors of general dental medicine were also surveyed, as well as the specialists in certain branches of dentistry (preventive and children's dentistry, oral medicine and periodontics, dental pathology and endodontics, oral surgery, dental prosthetics, orthodontics).

According to its type, this is a cross-sectional study.

Data in this research were collected using the original questionnaire. The researchers sent an online survey to the e-mail addresses of the subjects. The questionnaires were sent to the e-mail addresses available to us.

All subjects voluntarily agreed to participate in the research and along with the survey they received a cover letter – Informed consent introducing them the type of research. A total of 156 questionnaires were sent. A total of 100 subjects responded to the questionnaire.

The questions related to the fact whether the subjects encountered patients wearing a fixed retainer and whether they noticed plaque accumulation, presence of calculus, gingivitis, gingival recession, periodontitis, caries and the rotation of teeth having a retainer attached to them.

The participants were told to answer the questions with YES or NO and thereby share their experiences related to the influence of fixed orthodontic retainer on their patients' dentoalveolar complex.

The results were statistically processed using the program Spss 23.0 Chicago.

## Results

Table 1. shows that all 100 subjects (100%) agreed that they had patients with a fixed orthodontic retainer.

In Table 2 we see that the most common changes observed were plaque in 90% and the presence of calculus in 81%, and at least with 15% the presence of periodontitis.

**Table 1.** Question 1: Have you had a patient with fixed orthodontics retainer in your practice?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	100	100.0	100.0

**Table 2.** The most common changes

The most common changes	YES	NO	Percent (%)
The presence of plaque	90	10	90
The presence of calculus	81	19	81
Presence of gingivitis	70	30	70
The presence of parodontal pockets	18	82	18
Presence of gingival recession	20	80	20
The presence of periodontitis	15	85	15
The presence of caries	35	65	35
The presence of tooth rotation	25	85	25
Soft tissue injury	22	78	22
Did the patients complain	25	75	25

**Table 3.** Statistics

	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10	Question 11
Chi-Square	61.792 <sup>a</sup>	36.842 <sup>a</sup>	15.059 <sup>a</sup>	41.832 <sup>a</sup>	34.465 <sup>a</sup>	49.911 <sup>a</sup>	9.515 <sup>a</sup>	25.752 <sup>a</sup>	32.168 <sup>a</sup>	25.752 <sup>a</sup>
df	1	1	1	1	1	1	1	1	1	1
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.002	.000	.000	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 50.5.

**Table 4.** Answer to question 2 by different specialties

Crosstab		Question 2		Total
		1	2	
Orthodontics	Count	13	1	14
	% within Grupe	92.9%	7.1%	100.0%
	Adjusted Residual	.5	-.5	
Oral medicine and periodontology	Count	8	0	8
	% within Grupe	100.0%	0.0%	100.0%
	Adjusted Residual	.9	-.9	
General dentistry	Count	55	8	63
	% within Grupe	87.3%	12.7%	100.0%
	Adjusted Residual	-.2	.2	
Preventive and pediatric dentistry	Count	5	0	5
	% within Grupe	100.0%	0.0%	100.0%
	Adjusted Residual	.8	-.8	
Dental pathology and endodontics	Count	4	0	4
	% within Grupe	100.0%	0.0%	100.0%
	Adjusted Residual	.7	-.7	
Dental prosthetics	Count	1	2	3
	% within Grupe	33.3%	66.7%	100.0%
	Adjusted Residual	-3.1	3.1	
Oral surgery	Count	4	0	4
	% within Grupe	100.0%	0.0%	100.0%
	Adjusted Residual	.7	-.7	
Total	Count	90	11	101
	% within Grupe	89.1%	10.9%	100.0%

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.664 <sup>a</sup>	8	.124
Likelihood Ratio	10.612	8	.225
Linear-by-Linear Association	.832	1	.362
N of Valid Cases	101		

a. 14 cells (77.8%) have expected count less than 5. The minimum expected count is .22.

**Table 3. – statistics**

In Table 4, Question 2, plaque involvement in patients with fixed orthodontic retainers, was the mostly answered by general dentists. 55 out of 90 of them are from the field of general dentistry. The second are orthodontists. 13 out of 90 reported plaque in patients with fixed orthodontic retainers.

In Table 5 Question 3- Presence of calculus in patients with fixed orthodontic posture where answers were mostly given by general dentists, 63 out of 81 are general dentists.

Regarding other issues, general practitioner noted that it is mostly variable in patients with fixed orthodontic retainers.

Table 5. Answer to question 3 by different specialties

Crosstab		Question 3		Total
		1	2	
Orthodontics	Count	13	1	14
	% within Grupe	92.9%	7.1%	100.0%
	Adjusted Residual	1.3	-1.3	
Oral medicine and periodontology	Count	8	0	8
	% within Grupe	100.0%	0.0%	100.0%
	Adjusted Residual	1.3	-1.3	
General dentistry	Count	50	13	63
	% within Grupe	79.4%	20.6%	100.0%
	Adjusted Residual	.9	-.9	
Preventive and pediatric dentistry	Count	5	0	5
	% within Grupe	100.0%	0.0%	100.0%
	Adjusted Residual	1.1	-1.1	
Dental pathology and endodontics	Count	3	1	4
	% within Grupe	75.0%	25.0%	100.0%
	Adjusted Residual	-.3	.3	
Dental prosthetics	Count	1	2	3
	% within Grupe	33.3%	66.7%	100.0%
	Adjusted Residual	-2.1	2.1	
Oral surgery	Count	1	3	4
	% within Grupe	25.0%	75.0%	100.0%
	Adjusted Residual	-2.8	2.8	
Total	Count	81	20	101
	% within Grupe	80.2%	19.8%	100.0%

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.176 <sup>a</sup>	8	.020
Likelihood Ratio	17.946	8	.022
Linear-by-Linear Association	8.926	1	.003
N of Valid Cases	101		

a. 13 cells (72.2%) have expected count less than 5. The minimum expected count is .40.

## Discussion

The results of the conducted study showed that a large number of subjects (90%) had patients with fixed orthodontic retainer meaning that this type of retention is widely used. More than 90% of subjects responded that they noticed a higher accumulation of plaque in the area of teeth having a fixed retainer on them. Similar results were acquired by author Stroman and Ehner in their Prospective randomized study [10], as well as Wellington et al. [11]. Increased plaque accumulation is the first step in the onset of periodontal diseases, even though the results of the

study conducted by Herier and associates showed that, despite slightly increased plaque accumulation with fixed retainers, gingivitis does not occur during the first six months [12].

Of the total number of subjects, 81% of them noticed the presence of calculus, and 73% noticed the occurrence of gingivitis in the area of teeth having attached retainer on them being also confirmed by authors Pandis and Levin by conducting a clinical study [7, 9]. On the other hand, there are studies with results showing the opposite – namely, the fixed orthodontic retainer does not harm the gingival condition and periodontal health [8, 12]. A retrospective cohort study conducted by Juloski and

associates showed that fixed orthodontic retainer affects the increased calculus accumulation but not development of gingivitis [13]. Similar results were observed by a study comparing the effect of fixed and mobile retainers on the periodontal health concluding that an increased concentration of plaque and calculus was noticed with fixed retainers, but after a year it does not have any clinical significance on the periodontal health [17]. Some authors compared the types of fixed orthodontic retainers, thus, for example, in their research Ferreira and associates compared a conventional 3 x 3 ordinary retainer (orthodontic 0,8 mm wire, attached only to the canines) and the stainless steel 0,2 x 0,7 mm retainer, attached to all front teeth, and on the basis of results acquired during the study, they concluded that conventional holders attached only to the canines showed less damaging effects on the periodontal health and the occurrence of caries in relation to the retainers attached to all front teeth [22].

A smaller percentage of subjects noticed the presence of gingival recession (20%), periodontitis (15%), caries (35%), teeth rotation (25%) being also confirmed by the clinical study by Andrew and associates who came to the conclusion that wearing fixed retainers is not related to the occurrence of periodontal diseases [14]. Baeshen and associates examining the frequency of occurrence of caries and other risk factors in adolescents with fixed retainer in Sweden, found that one third of subjects had medium/high number of cariogenic bacteria in their saliva, leading to the connection of fixed orthodontic retainers and the occurrence of caries [19].

Slightly higher percentage of caries presence in teeth having fixed retainer (35%) could be explained by more difficulties in maintaining hygiene, as well as the inability to use floss and clean interdental spaces. However, two review papers were published showing the evidence that routine directions for using dental floss are not supported by scientific evidence [15] and that there is no reliable proof that the use of floss along with brushing is related to the reduction of plaque [16]. In their research, Erbe and associates, guided by somewhat difficult plaque control in patients with fixed orthodontic retainer, compared the effects of different brushing techniques and came to the results that an electric toothbrush shortened brushing time with overall

more efficient plaque removal in comparison to a handheld toothbrush. Adolescents are often inconsistent in their oral hygiene, but the use of electric toothbrushes can lead to the improvement of motivation regarding brushing and cleaning efficiency [20]. In their research, Alhaija and associates examined general awareness of orthodontic patients of the importance of maintaining oral hygiene and plaque control during and after the orthodontic therapy duration coming to the conclusions that the patients are insufficiently motivated and informed about the need for more frequent checkups and increased dedication to tooth brushing, which additionally increases the occurrence of harmful effects of fixed orthodontic retainers on dental health [21].

In their research, Perkowski and associates presented a comparative qualitative analysis showing that the therapy with fixed orthodontic apparatus and fixed retainers alters the status of the oral cavity having an influence on it being colonized by various opportunistic/pathogenic strains [23].

The presence of teeth rotation having a fixed retainer attached (25%) speaking about the efficiency of the retainer to keep the teeth in desired position. A clinical randomized study evaluating the efficiency of fixed retainers concluded that they are the most efficient in preventing relapse in the labial segment [18].

The limitations of this study are in the fact that data was collected using a questionnaire thus we recommend clinical study to be conducted on the territory of Bosnia and Herzegovina in order to collect more relevant data.

## Conclusion

There are harmful effects of fixed orthodontic retainers on the condition of dentoalveolar complex. The most common harmful effects are the presence of plaque, as well as calculus and gingivitis in teeth having fixed retainer attached to them. As the harmful effects are connected to the oral hygiene maintenance, the study conclusion is that the patients not maintaining impeccable oral hygiene are contraindicated for the installment of fixed orthodontic retainer.

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