

# Dentists' Awareness of white spot lesions during treatment with fixed orthodontic appliances

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## Abstract

**Introduction:** Fixed orthodontic appliances are used for the treatment of jaw deformities for a certain period of time, but they are a risk factor for development of dental caries, because they are retentive and support plaque accumulation. The elements of fixed orthodontic technique can change the biological balance in the oral cavity and put the patients treated with such orthodontic appliances at high risk of developing dental caries.

**Aim:** The aim of the study is to determine the dentists' awareness of white spot lesions as a side effect during orthodontic treatment with fixed appliances and the methods for their diagnostics, prevention and treatment.

**Material and Methods:** The study includes 200 dentists, members of the Bulgarian Dental Union, randomly selected. Their knowledge was evaluated through an anonymous questionnaire of 15 questions.

**Results:** *The results from the survey indicates a low level of awareness of the dentists surveyed about white carious lesions and poor knowledge about the management with various preventive methods. This requires the creation of a methodological guideline for all dental practitioners.*

**Keywords:** white carious lesions, white spot lesions, prophylactic care, fixed orthodontic technique, dentists, oral health.

## Introduction

Fixed orthodontic appliances which are used for treatment of jaw deformities for a certain period of time are a risk factor for development of dental caries, because they are retentive and support the plaque accumulation. The elements of these appliances can change the biological balance in the oral cavity and put the patients treated with such orthodontic appliances at high risk of developing dental caries.

The long-standing problem with the development of white spot lesions (WSL) during treatment with fixed orthodontic technique has been investigated for many years through in-vitro, in-situ, ex-vivo and in-vivo studies, using different assessment methods and various protocols for their treatment have been tested.

## Aim

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## Materials and Methods

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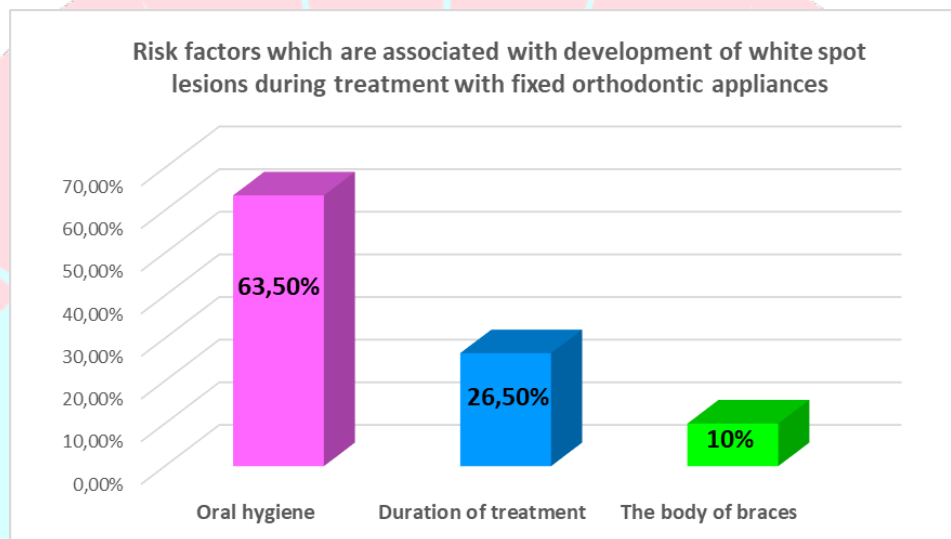
## Results

All respondents work in urban conditions, of whom 82 are men and 118 are women. Most of the respondents are between 28 and 47 years old (53.7%), about one-third - between 51 and 63 years old (37%) and the smallest part is over 65 years old (9.3%). Of these, 56.7% have over 10 years of professional experience, 30.8% with 5 to 10 years of experience and 12.5% with up to 5 years professional experience.

There are predominantly colleagues with no specialty (56.6%), the other colleagues are with one specialty and it is general dentistry (25.8%) and the rest with two specialties - general dentistry and conservative dentistry (4.3%), general dentistry and prosthetic dentistry (5.8%), general dentistry and pediatric dentistry (5%) and general dentistry and orthodontics (2.5%).

The majority of the respondents (73.8%) believe that white spot lesions are related to orthodontic treatment, and according to the others there is no relation between white spot lesions and orthodontic treatment (26.2%).

Fig. 1 presents results for the knowledge of the respondents about the risk factors that are associated with development of white carious lesions during treatment with braces.

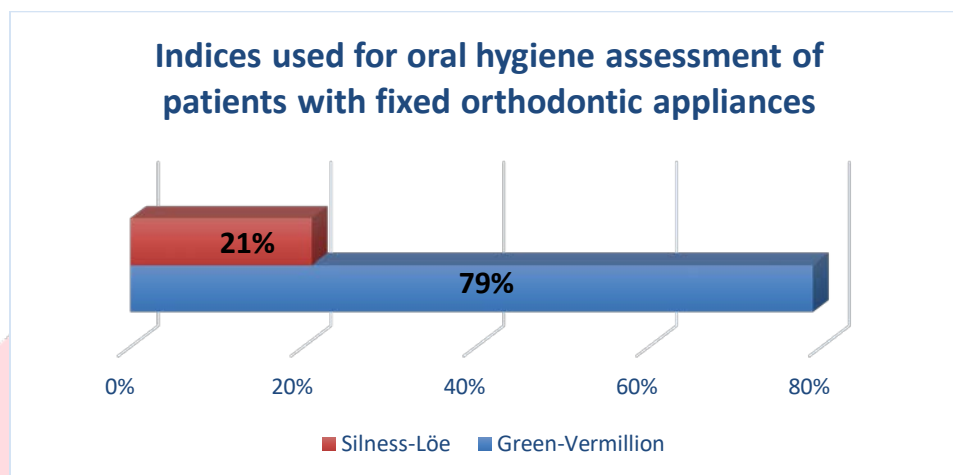


**Figure 1. Risk factors which are associated with development of white spot lesions**

Most of the dentists' opinion (63.5%) is that the oral hygiene is the main risk factor for the development of white spot lesions. The other colleagues indicated the duration of orthodontic treatment (26.5%) and the body of the braces (10%) as risk factors for development of WSL.

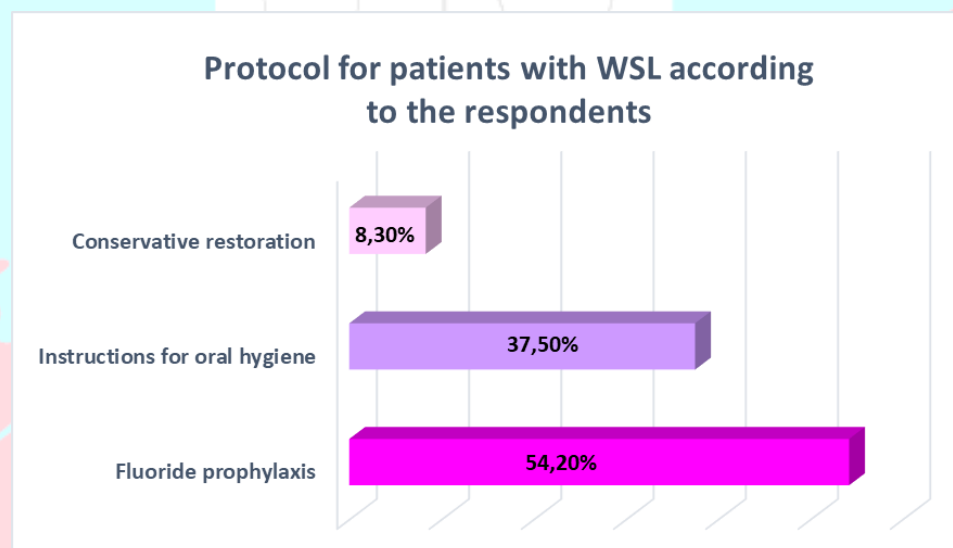
The relative share of colleagues who indicated that they used DIAGNOdent for the diagnosis of white caries lesions is low (15.8%), the others noted the use of visual diagnostics during clinical examination of the patient (84.2%). The same results were reported for the assessment of lesion severity.

The majority of dental specialists (79%) noted that they used the Green-Vermillion Oral Hygiene Index for representation of the dental biofilm in patients with braces, the other (21%) said they were using the Silness-Löe index. These conclusions are demonstrated in Fig. 2.



**Figure 2. Indices used for oral hygiene assessment**

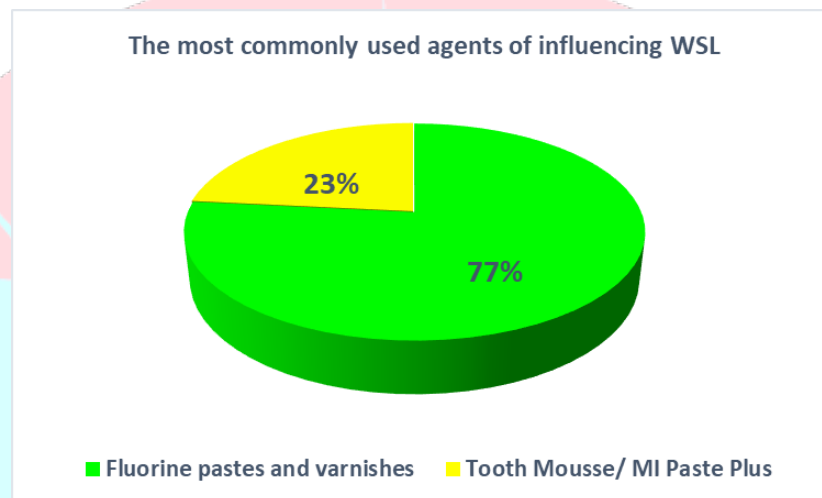
On the question what kind of protocol the dentists follow in cases of patients with white spot lesions treated with fixed technique prevails the responses for application of fluoride medicines for their treatment and fluoride toothpaste usage (54.2%), improvement of oral hygiene (37.5%) and conservative restorations (8.3%). The results are shown in Fig. 3.



**Figure 3. Protocol for patients**

In our study we emphasized the caries risk assessment as one of the most successful strategies for impact the dental caries in the last 15-20 years. The results show that very few respondents use it in patients with braces (13.3%).

From all the products available on the dental stores for prevention and non-operative treatment of white spot lesions, the respondents indicated the fluoride toothpastes and the fluoride varnishes (76.6%), while others noted Tooth Mousse (MI Paste) and MI Paste Plus (23.4%) as the most commonly used agents for WSL remineralization and respectively improvement in their condition. The results obtained are demonstrated in Figure 4.



**Figure 4. The most commonly used agents**

On the question of dental specialists' impressions about the effectiveness of the different methods of influencing white spot lesions, most of them have no impressions because they do not track the effect of their application (53.3%). Another part of the respondents said that there was no effect of their application (21.35%), while the others said that their effect on white carious lesions was slightly positive (25.35%).

On the last question, all respondents (100%) answered that there is a need for information about white caries lesions and creating an algorithm for their influence.

## Discussion

The distribution of respondents in our study indicates a higher relative share of female participants. For comparison in another study, female participants also prevail (1). Similar results for the indicators "years of professional experience" and "age of the participants" were also reported by Eslamipour's research team (1). The results from the survey for "years of professional experience" and "age of the participants" show that most of the dentists surveyed have great professional experience.

The duration of treatment affects the development of white carious lesions. It was found that when prolonging the time duration for orthodontic treatment from 24 months to 36 months, the possibility of formation of these lesions increased by 3.65 times (2). Tufekci et al. and Lucchese and Gherlone concluded that these lesions predominantly appear in patients undergoing orthodontic treatment for 6 months (38% and 40%, respectively), increasing this tendency by prolonging the duration of treatment for 12 months (46%

and 43%), supporting the idea that the presence of fixed orthodontic appliances and longer treatment periods serve as a risk factors for the formation of white carious lesions (3, 4). Similar observations are made by Julien and colleagues (5).

The small relative share of respondents that the body of the braces is a risk factor for the development of these lesions indicates that colleagues are poorly informed that the body of the braces seriously impairs oral hygiene and limits the self-cleaning from the saliva (6). The zones around the fixed braces are pre-lection areas for the accumulation of a larger amount of dental plaque. All this predisposes to decrease the pH in the dental biofilm and in the presence of carbohydrates in patient's diet, a physical barrier is formed that disturbs remineralization with the calcium and phosphate ions from the saliva (7, 8). All these changes in the oral ecosystem help to increase the levels of *S. mutans* and *Lactobacillus* spp., mainly around the adhesives that fix the orthodontic appliances (9).

The respondents are unaware of the visual detection of white spot lesions using the Gorelick's index, which is specially created in 1982 for assessment of these lesions (The WSL index) (10), as well as the EDI index (Enamel Decalcification Index) by Banks and Richmond (11). Moreover, the modern diagnostics of reversible carious lesions uses modern methods of registration. Such a method is the method of laser fluorescence with the DIAGNOdent pen, which is very useful for detecting white carious lesions around the braces (12, 13, 14) during and after orthodontic treatment (15).

In the scientific community it is often commented that the OPI index created by Beberhold and colleagues (16) is the gold standard for recording oral hygiene levels in patients treated with fixed orthodontic technique (17). Currently available indices do not adequately meet the special requirements of patients with fixed orthodontic technique, because they evaluate only the smooth surfaces and approximal tooth surfaces with respect to plaque buildup and signs of gingival inflammation (16). The OPI focuses on the area adjacent to the braces – the area that is another additional plaque-retentive surface and this makes it particularly appropriate for the specific group of patients studied (16).

The largest share of the participants in our study indicated that in the protocol they applied, they recommend the use of fluoride prophylaxis. In support of our data are the results of the Eslamipour et al. who show that 57% of orthodontists most often recommend the use of fluoride mouthwash as a preventive method against white carious lesions (1).

The results from our study are highly disturbing because there are no answers that show a complex approach to recover these lesions, which are also a serious aesthetic problem in these patients. Sporadic promotion and advices about oral hygiene, eating habits or prophylactic measures are insufficient to stationating or even remineralize white carious lesions (18). It is necessary to create an algorithm to help each dental specialist to deal with these lesions.

Regular use of fluoride toothpaste is the most common recommendation, but research shows that it is not effective in preventing white lesions around orthodontic braces (19). The use of fluorides is highly dependent on the patient's cooperation (20).

To date, very few studies have been conducted on the awareness of the occurrence and complex prevention of white carious lesions during orthodontic treatment. There is scarce data on the knowledge of both patients and dentists.

In 2018, Abdullah et al. conducted a similar to our study about patients' awareness about white spot lesions and their relationship with fixed orthodontic technique (21). The results show poor patient knowledge of these lesions as a complication during orthodontic treatment. The authors conclude that, despite strict prevention instructions by orthodontists, patients demonstrate both poor oral hygiene and a significant prevalence of white spot lesions (21).

Another study in 2017 by Eslamipour and colleagues found a good level of knowledge by orthodontists about the risk factors during treatment with fixed technique (1), but white carious lesions still remain a clinical challenge related with fixed orthodontic treatment. The authors recommend a more detailed study of the factors leading to the development of this problem.

The caries risk assessment is very important for patients with braces because the latter are a serious risk factor for the development of initial carious lesions in the form of a white spot. The elements of the fixed technique are a serious risk factor because they create additional plaque-retentive surface and increase the possibility of a carious process (23). The results of our study show that a very small number of respondents use the oral risk profile in patients undergoing fixed orthodontic treatment. With the development of knowledge it becomes clear that this is a process that begins its development long before the appearance of a carious lesion (24). All the factors that lead to the development of a carious process are known as "risk factors" (24). Therefore, the carious process must be managed through the perception as a whole. This provides a preventive approach and methods for treatment and prevention that are addressed primarily to the causes and reversible nature of the disease (25).

As mentioned earlier, the use of fluorides is highly dependent on patient cooperativity. Moreover, it is already known that effective prevention is one that has the character of a complex management program. The fluoride toothpaste alone is insufficient to prevent the subsequent development of white carious lesions during treatment with fixed orthodontic technique. Remineralization requires both fluorine ions and calcium and phosphate ions. They are contained in modern remineralizing agents that contain casein-phosphopeptides as the main ingredient (MI Paste, ReminPro) (25).

According to some authors, the impressions from the use of different preventive measures will be relevant if they tracked over time and not just applied on an occasional basis. It was indicated that as the severity of white carious lesions increases, the rate of improvement from different measures will decrease (26). This finding has high clinical relevance, since, after bracket debonding, the clinician must decide whether to wait for spontaneous regression or improvement, adopt adjunctive measures to enhance improvement, or refer the patient for restorative measures (26). These findings are supported by the opinion we advocate for the use of non-operative preventive treatment of initial carious lesions in the form of a white spot lesions, but also in combination with the risk assessment for oral environment modeling of patients treated with fixed orthodontic technique.

The result on the last question about the need for awareness clearly demonstrates the high responsibility of the dentists and their strong desire to enrich their knowledge of a complex approach. The preventive measures, which must be applied to patients with fixed orthodontic technique need to be in an algorithm for prophylaxis and treatment.

## Conclusion

The results obtained from the survey conducted by us clearly show that there is a need to provide more detailed information about the white spot lesions developing around the body of the fixed orthodontic appliances and to create an algorithm for their prevention and treatment. The caries risk assessment should also be present before placement of the fixed orthodontic appliances on the teeth and this evaluation should be done periodically.

## References

1. Eslamipour F, Shahmoradi M, Farhadi V. Assessment of Iranian orthodontists' practice with regard to the prevention and treatment of white spot lesions. *J Educ Health Promot.* 2017; 6:42.
2. Khalaf K. Factors Affecting the Formation, Severity and Location of White Spot Lesions during Orthodontic Treatment with Fixed Appliances. *Journal of oral & maxillofacial research,* 2014; 5(1): 2-12.
3. Lucchese A, Gherlone E. Prevalence of white-spot lesions before and during orthodontic treatment with fixed appliances. *Eur J Orthod.* 2013;35: 664–8.
4. Tufekci E, Dixon J, Gunsolley J et al. Prevalence of white spot lesions during orthodontic treatment with fixed appliances. *Angle Orthod.* 2011;81: 206–10.
5. Julien K, Buschang P, Campbell P. Prevalence of white spot lesion formation during orthodontic treatment. *Angle Orthod.* 2013;83: 641–7.
6. Cosma L, Şuhani R, Mesaroş A, et al. Current treatment modalities of orthodontically induced white spot lesions and their outcome - a literature review. *Med Pharm Rep.* 2019; Jan; 92(1): 25-30.
7. Jung W, Kim H, Park S et al. Quantitative analysis of changes in salivary mutans streptococci after orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2014; 145 (5): 603-9.
8. Moolya N, Shetty A, Gupta N, et al. Orthodontic bracket designs and their impact on microbial profile and periodontal disease: A clinical trial. *Journal of orthodontic science* 2014; 3(4): 125-31.
9. Marda A, Elhamzaoui S, Mansari A, et al. Evaluation of Changes in Cariogenic Bacteria in a Young Moroccan Population with Fixed Orthodontic Appliances. *International Journal of Dentistry,* 2018; 5939015; 2-4.
10. Gorelick L, Geiger A, Gwinnett A. Incidence of white spot formation after bonding and banding *American Journal Orthodontics,* 1982; 81(2): 93-8.
11. Wang J, Yan Y, Wang X. Clinical evaluation of remineralization potential of casein phosphopeptide amorphous calcium phosphate nanocomplexes for enamel decalcification in orthodontics, *Chin Med J.* 2012; 125 (22):4018-4021.
12. Hoskin E, Keenan A. Can we trust visual methods alone for detecting caries in teeth? *Evid Based Dent.* 2016 Jun;17 (2): 41-2.
13. Kavvadia K, Seremidi K, Reppa C, et al. Validation of fluorescence devices for evaluation of white spot lesions in orthodontic patients. *Eur Arch Paediatr Dent.* 2018;19 (2):83-89.
14. Mohanraj M, Prabhu R, Senthil R. Diagnostic methods for early detection of dental caries - A review. *Int J Pedod Rehabil.* 2016;1: 29-36.
15. Andersson A, Skold-Larsson K, Hallgren A, et al. Effect of a dental cream containing amorphous calcium phosphate complexes on white spot lesion regression assessed by laser fluorescence. *Oral Health Preventive Dentistry.* 2007; 5:229-233.
16. Beberhold K, Sachse-Kulp A, Schwestka-Polly R, et al. The Orthodontic Plaque Index: an oral hygiene index for patients with multibracket appliances. *Orthodontics: the art and practice of dentofacial enhancement,* 2012; 13 (1): 94-9.
17. Atassi F, Awartani F. Oral Hygiene Status among Orthodontic Patients. *The journal of contemporary dental practice,* 2010; 11(4): 25-32.



18. Zimmer B, Rottwinkel Y. Assessing patient-specific decalcification risk in fixed orthodontic treatment and its impact on prophylactic procedures. *Am J Orthod Dentofacial Orthop.* 2004; 126(3):318–24.
19. Pinto de Souza S, Araújo K, Barbosa J, et al. Effect of dentifrice containing fTCP, CPP-ACP and fluoride in the prevention of enamel demineralization. *Acta Odontol Scand.* 2018 Apr; 76(3):188-194.
20. Geiger A, Gorelick L, Gwinnett A, et al. The effect of a fluoride program on white spot formation during orthodontic treatment. *Am J Orthod Dentofacial Orthop.* 1988; 93:29–37.
21. Abdullah, Syiral & Azmi, Adibah & Mohamad, Rufaidah. Knowledge on white spot lesion (WSL) among fixed orthodontic patients: a pilot study. *International Journal for Studies on Children, Women, Elderly And Disabled*, 2018. Vol. 4, (June), 69-73.
22. Bishara S, Ostby A. White Spot Lesions: Formation, Prevention, and Treatment. *Semin Orthod.* 2008; 14:174-82.
23. Beck J. Risk revisited. *Community Dent Oral Epidemiol.* 1998; 26(4): 220-225.
24. Rashkova M, Peneva M, Doychinova L. Study of the risk factors for the development of dental caries and creation of a system for evaluation of the risk of caries in children – OHDMBSC 2008; VII (2): 3-11.
25. Robertson M, Kau C, English J, et al. MI Paste Plus to prevent demineralization in orthodontic patients: A prospective randomized controlled trial. *Am J Orthod Dentofacial Orthop.* 2011; 140:660-8.
26. Enaia M, Bock N, Ruf S. White-spot lesions during multibracket appliance treatment: A challenge for clinical excellence. *American Journal of Orthodontics and Dentofacial Orthopedics* 2011;140 (1):17-24.

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