White Spot Formation under Banded Molars after Orthodontic Treatment and Suggested Preventive Measures

Ahmad Tarawneh DDS, Ayman Hyasat DDS**

ABSTRACT

Objective: The presence of fixed orthodontic appliances in the mouth undoubtedly predisposes to the accumulation of plaque. Two favored sites for such accumulation are around the cervical margins of the teeth and under the molar bands. This study was carried out to find out the incidence and severity of white spots after a full term of orthodontic treatment under the molar bands.

Methods: The incidence of white spots under the molar bands of 75 patients (300 first molars) treated by fixed appliances in Queen Alia Hospital was recorded at the time of debonding during the year 2005. Direct clinical examination for the presence of white spots was made on the labial surface of the first molar teeth.

Results: Following debonding 93.3% of patients had at least one white spot and 50% of the examined molars had, to some extent, a degree of decalcification. There was no significant difference between male and female white spot distribution.

Conclusion: This study revealed that the incidence of white spots among this sample of Jordanian patients was very high. Of equal, if not greater, benefit would be the implementation of more stringent and more frequent preventive measures applied prior to and throughout the period of active treatment. Both patients and parents should be instructed and motivated on the importance and on how to maintain the highest standards of oral hygiene.

Key words: Demineralization, Enamel, Molar bands

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Introduction

While the objective of orthodontic treatment is a healthy, functional and aesthetic occlusion the presence of fixed orthodontic appliances in the mouth undoubtedly predisposes to the accumulation of plaque. Two favored sites for such accumulation are around the cervical margins of the teeth and under the molar bands.[(1)] Enamel demineralization is the second most common iatrogenic problem in orthodontic patients whose compliance with oral hygiene and preventive advice is poor.[(1)] Associated with fixed appliances is an extremely rapid process caused by a high and continuous cariogenic challenge in the plaque developed around brackets and underneath ill-fitting bands.[(2)] White spot lesions can develop very quickly-within a few weeks and consist of some softening of enamel surface with progressive mineral loss of sub-surface layer to a depth of 100 micrometers.[(3)] The white spot lesion is a precursor of enamel caries that occurs due to accumulation of plaque adjacent to brackets, and appears as a chalky white area at the cervical margin

*From the Department of Dentistry, King Hussein Medical Center, (KHMC), Amman-Jordan
Correspondence should be addressed to Dr. A. Al-Tarawneh, (KHMC), E-mail: josdrahmad@wanadoo.jo
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of teeth. Linear correlation between plaque accumulation and caries has been shown in orthodontic patients.[3]

The development of white spot lesions during fixed appliance orthodontic treatment is preventable. The chosen method or methods for prevention will be largely dependent on individual needs of each patient and opinion of clinician.[4] There are several methods of delivering fluoride to teeth in patients during orthodontic treatment. These include topical (fluoridated tooth paste, mouth rinse, gel and varnish) and adhesive (fluoride-releasing cements and elastomeric modules and chains) methods. The aim of this study was to establish the incidence and severity of white spots after a full term of orthodontic treatment under the molar bands.

Methods

This study involved patients selected from a public sector practice and the results reflect only the situation in that practice. The incidence of white spots under the molar bands of 75 patients (300 first molars) treated by fixed appliances in Queen Alia Hospital was recorded at the time of debonding. The cement used for all bands was Zinc phosphate cement. The average age was 16.2+3.2 years (50 females, 25 males). Direct clinical examination using a dental mirror and explorer before and after drying the buccal surface of the first molar teeth was made to detect the presence of white spots and the lesions were scored according to Gorelick *et al.* index[5] as follows (Fig. 1):

1. No white spot formation
2. Slight white spot formation
3. Excessive white spot formation
4. White spot formation with cavitations

Results

Of the 75 patients evaluated, only 5 (6.7%) patients had no white spot formation at all. Seventy (93.3%) had at least one lesion and they are distributed as follows: 24 (32%) patients had only one first molar affected, 22 (29.3%) patients had two first molars, 16 (21.3%) patients had three first molars and finally 8 (10.7%) of patients had all first molars affected (Table I). With regard to the total number of first molars (300), 150 (50%) of the first molars examined had to some extent a degree of decalcification, 23 (7.7%) had white spot formation with cavitations, 44 (14.7%) molars had excessive white spot formation, while the highest percentage was 83 (27.6%) for the slight white spot formation (Table II). The Chi-square test was used to compare the gender distribution between the affected and non-affected patients (Table III) and no significant differences were found.

Discussion

Results of this study showed that following orthodontic treatment there was a significant increase in the prevalence of white spot lesions underneath banded molars. With regard to the patients examined, the prevalence of white spot formation and severity of enamel opacities on the maxillary and mandibular first molars is much higher than that reported in other countries. Prevalence varies within the published literature. Deep and rapid demineralisation can occur in as little as four weeks,[4,6] Mizrahi[7] found that 84% of teeth post orthodontic treatment showed white spot lesions. Fifty percent of patients have at least one white spot lesion after treatment and 6% have cavitations.[6] The maxillary lateral incisors are the teeth most susceptible to severe white spot formation followed by the lower canine, upper canine, lower 1st premolar and lower 1st molar.[8]

Other studies have found that the greatest prevalence of white spot lesions is on 1st molars, canines, premolars and of the anterior teeth lateral incisors are more affected than central incisors.[9] The number of white spots in mandibular molars was significantly higher than maxillary molars. This may be associated with the location of salivary glands which results in accumulation of a greater amount of saliva around maxillary molars causing increased mineralization of these teeth.[10] These large variations might be the result of the difficulty in standardizing clinical examination, the variety of detection methods, or the presence of white spots before the start of orthodontic treatment.[11] Ideally, the appearance of the tooth should be recorded before and after orthodontic treatment so that the change in appearance of the tooth is measured (incidence), not just the appearance at the end (prevalence).[12]

Orthodontic treatment may be hazardous to the patient who has no motivation, no prophylactic program and poor supervision. It is the clinician's responsibility to detect these lesions. Careful inspection of the appliance at every visit and preventive fluoride programs is therefore required.[4] Well-cemented orthodontic bands protect

Score 1 ***Score 2*** ***Score 3*** ***Score 4***

Fig. 1. Gorelick *et al*. index[5]: Score 1 (no white spot formation), Score 2 (slight white spot formation), Score 3 (excessive white spot formation) and Score 4 (white spot formation with cavitations)

Table I. Number of molars affected in each patient

No. of patients	Affected 1st molars	%
5	Zero	6.7
24	One 1st molar	32
22	Two 1st molars	29.3
16	Three 1st molars	21.3
8	Four 1st molars	10.7

Table II. Score given for each molar

No. of molars	Score	%
150	1	50
83	2	27.6
44	3	14.7
23	4	7.7

Table III. Comparison of gender distribution between the affected and non-affected patients

Gender	Affected (n=70)	Non-affected (n=5)	Total (n=75)
Male	24(34%)	1(20%)	25(33%)
Female	46(66%)	4(80%)	50(67%)
Total	70	5	75

P-Value=0.512

completely covered tooth surfaces against caries.[2] It makes though, the partly covered surfaces more susceptible to caries and destruction.

The progression of the caries process is retarded under a well fitting band. This is of value if caries went undetected at the initial stage of banding.[3] Caries development underneath orthodontic bands in the absence of fluoride is a very rapid process caused by a high cariogenic challenge in the plaque. In the light of available evidence regarding the aetiology of demineralization during fixed appliance therapy, the best preventive strategy would appear to be an assessment of risk factors prior to banding, coupled with fluoride rinse, regular reinforcement of oral hygiene, and dietary advice throughout the treatment.[13] Daily mouth rinsing with a neutral 0.2% NaF solution retarded lesion development significantly. Thus fluoride applied as a mouth rinse has a marked cariostatic effect even in poorly accessible locations underneath orthodontic bands. However, 0.05% NaF solutions is the recommended daily use mouthwash. The 0.2% NaF solutions is the recommended dose for the high-risk patients. The released fluoride influences the demineralisation and remineralisation process of the enamel surface, resulting in more resistant enamel underneath the bands. Once the orthodontic treatment is completed and the appliance is removed, no further progression of lesions will occur since the cariogenic challenge has ceased.[14]

The general belief that these lesions disappear after removal of fixed appliances is controversial. White spot lesions developed during orthodontic treatment have very limited ability to improve after appliance removal[15] and in many cases these lesions remain visible as permanent enamel scar. The cariostatic action of topical fluoride concept is related to the fluoridation of the enamel in the form of fluorohydroxyapatite. Visible white spots on the facial surfaces developed during orthodontic therapy should therefore not be treated with concentrated fluoride agents since this procedure will arrest the lesions and prevent complete repair.[15,16] Carious lesions developed in caries susceptible areas like proximal surfaces and the gingival part of facial and lingual surfaces of posterior teeth should be treated

topically to prevent further lesion progression.[15] Significant numbers of patients exhibit white spot lesions after orthodontic treatment. Lesions develop quickly and consist of enamel surface softening with progressive mineral loss of the substrate layer. Smooth surface caries lesions of this type do remineralise following removal of aetiological factors. Despite the preventative measures, there will be patients with unsightly white spot lesions after debonding presenting challenge for restorative treatment. It seems that low doses of fluoride in mouth washes do not improve these lesions.[17]

Allowing remineralization by saliva and the use of hydrochloric acid 10 weeks after debonding is suggested[17,18] The procedure can be recommended as a first line treatment option in cases with unacceptable post-orthodontic decalcification.[18] Since more than 50 per cent of the teeth studied exhibited no white spot formation, the potential influence of individual differences in enamel structure, composition of saliva, tooth brushing, and other variables remain questions to be investigated**.**

I. Prevention:

For a better understanding of whether and which preventive measures will be most efficacious, knowledge is required about the beginning and natural behaviour of these orthodontic-related white spots.[16]

- Prevention is the best cure. Good communication is essential to ensure both patient and parent are aware of the risks of treatment.[19]
- Begin with appropriate patient selection. Exclude patients with poor oral hygiene and evidence of active caries
- Diet control
- Close monitoring of patients is essential throughout treatment. Linear correlation between plaque accumulations and white spot formation.
- Demineralization can be completely inhibited and/or reversed by the use of commercially available fluoride products.[20]
- All patients under treatment should receive instruction on tooth brushing using fluoride containing tooth paste and to reduce daily exposure to refined carbohydrate including acidic drink[5] in addition to daily rinsing with a 0.05% sodium fluoride mouth rinse throughout treatment.[13,9]
- Written and verbal information must be given. Videos serve to reinforce this information.
- Select proper band size and should be tightly fitted.
- Routine checking for loose bands. Bands should be checked for retention at every visit
- Use glass ionomer cement for banding because of fluoride release and retentive properties.[21]
- Obtain maximum coverage of enamel by placing a thumb on the occlusal surface of the band so that cement is expressed gingivally.
- The use of fluoride releasing elastomeric modules reduce but not eliminate the incidence of decalcification.[22]
- Light cured filled sealant (Pro Seal) can be considered as a preventive method to reduce enamel demineralization adjacent to orthodontic attachments, particularly in patients who exhibit poor compliance with oral hygiene and home fluoride use.[23].
- The use of bonded molar tubes instead of bands remains a good option when there is no need for auxiliaries.
- Should white spot lesions occur, these should be mentioned to the patient/parent with an explanation of why they have occurred.
- Removal of arch wires and bands for a visit may help oral hygiene procedures.
- As a last resort the appliance may be removed.

II. Treatment:

- Early diagnosis of white spot lesions by the clinician is a matter of great importance. White spot lesions are an optical phenomenon due to subsurface demineralization. The enamel surface is usually intact and acts as a porous surface across which fluoride ions can pass. High doses of fluoride in the form of fluoride varnish e.g. Duraphat should be avoided. This seals the enamel surface and thus the demineralized area for life, in addition to staining the enamel. It is best to use a low dose of fluoride in the form of toothpaste.
- Patients should be reassured that the appearance will improve over the next year. They should also avoid food and drink that may stain the porous enamel – black tea/coffee.
- Staining persisting beyond this time may be treated by various methods from the most conservative (acid pumice micro abrasion),[18] to

more definitive treatments for cavitations (class V composites, veneers etc).

Generally speaking, orthodontic treatment need not cause any appreciable damage when accepted orthodontic principles are followed in co-operative patients with good oral hygiene and regular fluoride supplementation. On the other hand, when these principles are neglected, the damage may be considerable and the benefits from orthodontic treatment questionable

Conclusion

White spot formation under molar bands is one of the risks of orthodontic treatment. This study revealed that the incidence among this sample of Jordanian patients is very high. Of equal, if not greater, benefit would be the implementation of more stringent and more frequent preventive measures applied prior to and throughout the period of active treatment. Prior to the start of active treatment, both patients and parents should be instructed and motivated on the importance and on the manner of maintaining the highest standards of oral hygiene. During treatment, the use of tightly fitting and correctly adapted bands as well as routine checking for loose bands remains the responsibility of the orthodontist. Fluoride-containing dental cements should be used for all cementing procedures.

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