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Assessment of Acquired Enamel Demineralization in Subjects Treated with Fixed Orthodontic Multi-Bracket Therapy

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KEYWORDS

Orthodontics, Fixed appliance, Iatrogenic, White spot lesions

ABSTRACT:

Introduction: Malocclusion is a serious oral health issue that requires orthodontic correction. Fixed orthodontic appliances are known for acquired enamel damage.

Objectives: To evaluate the incidence of iatrogenic white spots in subjects treated with fixed orthodontic therapy.

Methods: This was a retrospective study. The study sample included the orthodontically treated subjects debonded during the study period. A photographic technique was followed to evaluate enamel white spots. Teeth debonded after orthodontic therapy were evaluated and compared with pre-treatment records.

Results: A majority of subjects were young adults. Maximum subjects were school going children from the rural background. Maxillary Incisors were the most affected tooth while maxillary posteriors were least affected with white spot lesions.

Conclusions: Orthodontic treatment includes some amount of enamel damage as an inevitable factor. White spot lesion is prime concern for orthodontists. Oral hygiene maintenance and demineralization prevention remains the gold standard strategy.

1. Introduction

Orthodontic treatment poses strenuous oral hygienic maintenance, predominantly in subjects with fixed appliances. The most undesirable sequelae of compromised hygiene is development of white spot lesion.[1] The burden of cariogenic bacteria is reported to intensify in relation to other pathogens throughout fixed orthodontic therapy. [2-4] The condition is attributed to plaque retentive areas underneath the orthodontic attachment in addition to microflora-dental material interaction. [5-6]

This transient disbiosis is testified to revert after debonding without specific intervention, with concurrent decrease in white spots. [7] These white spots, the earliest stage of caries, are portrayal of demineralization and may subsequently transform into frank caries.[8-9]

These transmuted enamel surfaces scatters light intensely, hence the clinical presentation is related to optical properties of enamel. [2,10] Differential diagnosis plays key role in deciding type of intervention. Drying the lesion, visual inspection and probe examinations differentiates it from caries.[3,8] These acquired enamel surface defects are also unique for its site, size and shape. [11]

Literature reports the prevalence of white spot lesions in orthodontic subjects from negligible to almost cent percent. [8] The prevalence has increased recently particularly in subjects inattentive to oral care. [12-13]

Direct visualization and/or photographic examination are the two traditional in-vitro diagnostic technique for white spot lesions. [1] The present study aimed to evaluate the incidence of acquired enamel white spot

Journal of Chemical Health Risks

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lesions in subjects treated with conventional fixed orthodontic appliances.

2. Methods

The study was conducted at Department of Dentistry (Orthodontics), All India Institute of Medical Sciences, Kalyani, to determine the prevalence and incidence of enamel white spots among subjects treated with orthodontic fixed appliances.

Inclusion Criteria: The subjects comprising any types of malocclusions. All subjects with full available records, treated at our institution with fixed orthodontic appliance and debonded during the study period were included.

Exclusion Criteria: Re-treatment subjects were excluded from the study. No subjects were excluded on the basis of age and gender, or the on the basis of treatment mechanics.

Sample size: Considering the nature of the current study design i.e; retrospective. Prior sample size calculation was not done.

Study sample: All orthodontic subjects debonded from February 2024 to May 2024 were included in the study. Considering the inclusion and exclusion criteria the total sample size of our study was 36.

Ethical Approval: The study was approved by institutional Research and ethical committee (Ref. No.: IEC/AIIMS/Kalyani/certificate/2024/305).

Evaluation of WSLs:

The pre and post treatment intra oral photographs were assessed for prevalence and incidence of white spot lesions. All the photographs were captured in high dynamic range using the same Android phone camera. The anterior segment photography was done directly while the posterior segment images were captured indirectly with the help of highly polished stainless steel intraoral photographic mirror.

In both the arches, teeth from second premolar to second premolar were evaluated. Tooth extracted during the treatment were not evaluated. Molars were excluded because of inadequate visibility on photographs. A total of 650 teeth were available for photographic evaluation and comparison. The photographs were also evaluated for, whether white spot lesions has improved or worsened.

This modified photographic technique used the principles of "Direct Clinical examination for the presence of white spots- Gorelick L et al 1982" was used. [11] The teeth evaluated were scored as follows -

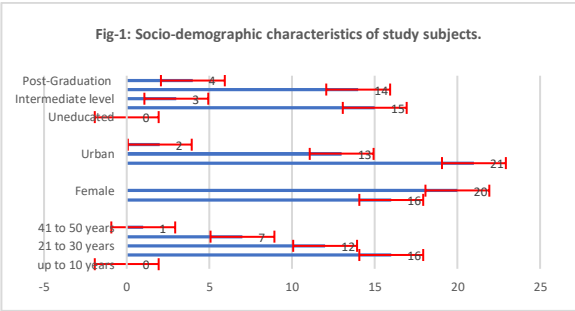
Score	Definition
0	No evidence of white spot
1	Mild white spot
2	Significant white spot
3	White spots with caries

Data analysis was done using SPSS version 23.0. Descriptive statistics were calculated and Chi square statistics were used to compare the difference between the groups. The $p<0.05$ was considered significant and confidence level was predetermined at 95%.

3. Results

The pre and post treatment photographs of orthodontic subjects were evaluated for white spot lesions. The study sample consisted of 16 male, 20 female subjects. A total of 650 teeth debonded after orthodontic therapy were evaluated and compared. All subjects had a history of treatment with MBT / Metal / O.022 brackets, with bands till second molar. The subjects were using specialized orthodontic brush along with over the counter fluoridated tooth paste during the treatment.

Fig-1 shows socio-demographic characteristics of the subjects. Almost 75 % subjects were in the age group 11to 20 years and 21 to 30 years. Maximum subjects were school going children from the rural background.



Frequency of white spot lesion in untreated and treated individual teeth is shown in table 1. Maxillary arch tooth

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were affected more compared to mandibular arch tooth. In both the arches, central and lateral incisors showed maximum amount of white spot lesions, followed by second premolars. Canines and first premolars were least affected by white spot lesions. The incidence of white spot lesions increased significantly compared to prevalence in both arches.

Table 1: Tooth wise Frequency of white spot lesion in pre treatment and post treatment subjects

	Pre Treatment		Post Treatment	
	n	%	n	%
Maxillary arch				
Central incisors	21	29.17	22	30.56
Lateral incisors	14	19.44	16	22.22
Canines	5	6.94	4	5.56
1st Premolar	2	2.78	4	5.56
2nd Premolar	10	13.89	14	19.44
Mandibular arch				
Central incisors	10	13.89	11	15.28
Lateral incisors	8	22.22	12	33.33
Canines	4	5.56	5	6.94
1st Premolar	0	0	8	11.11
2nd Premolar	7	9.72	12	16.67

569 of the 650 teeth were sound at pre-treatment. All the affected tooth with white spots were in grade 1 on pre-treatment. The number of tooth affected with grade 1 white spots increased to 102 at the end of treatment and 06 teeth in grade 2. (Fig-2)

The segment wise description of teeth affected by WSl is shown in table 2.

Table 2: Segment wise frequency of teeth affected by WSL.

Segment	Total teeth bonded	Pre Treatment		Post Treatment	
		n	%	n	%
Maxillary anterior	212	40	18.9	48	22.6
Right	106	21	19.8	24	22.6
Left	106	22	20.8	24	22.6
Mandibular anterior	213	22	10.3	32	15.0
Right	107	12	11.2	17	15.9
Left	106	10	9.4	15	14.2
Maxillary posterior	108	12	11.1	20	18.5
Right	53	4	7.5	8	14.8
Left	53	8	11.1	12	16.7
Mandibular posterior	117	7	6.0	23	19.7
Right	58	3	5.2	10	16.9
Left	59	4	6.8	13	21.7

4. Discussion

Enamel decalcification and successive white spots are the inevitable consequence of orthodontic therapy. The condition usually is reversible but may require intervention. [2,9] Demineralization prevention and reassuring remineralization is gold standard treatment. Differentiating the lesion from caries helps in decision making for type of intervention. [1] Early recognition and timely intervention is the key interceptive technique.[14,15]

Poor oral hygiene maintenance and low fluoride exposure have additive effect. The relationship between duration of orthodontic treatment and occurrence of enamel defects remained inconclusive. [7]

The reported prevalence for enamel white spot lesion in literature is between 2% and 96%. A prevalence of 68.4 percent and an incidence of 45.8 percent is reported in Meta-analysis. Patient compliance is assumed responsible for this wide range of prevalence. The current study observed a very low prevalence and incidence of WSL, due to better oral hygiene maintenance during therapy. [14,16]

Journal of Chemical Health Risks

www.jchr.org

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Maxillary incisors, especially lateral incisors are reported to be affected most. (9) Our study observed similar results with incisor prevalence. Study reports on incidence and prevalence amongst gender remained indecisive, with reported more male prevalence. Females are also reported to care better oral hygiene. Effect of age on post orthodontic enamel defects also have dissimilar study results. Yet, adolescents are described to be affected more, probably due to their ignorant behaviour for oral hygiene maintenance. [12]

The resultant microbial dysbiosis is also attributed to oral microbial physiochemical interaction with orthodontic material. Nanoparticle modified materials demonstrate antimicrobial property, re-mineralizing capacity and reduces frictional resistance. But, also distress microflora and fears resistant species. [5-6]

Topical fluoride is available at an affordable price hence is the most preferred and trusted re-mineralizing agent. Titanium tetrafluoride demonstrated better efficacy than sodium fluoride. [17-18]

The other treatment options include, low intensity laser irradiation, bioactive glass, Calcium Sucrose Phosphate and Resin infiltration. [17-19]

5. CONCLUSION

Orthodontic treatment includes some amount of enamel damage as an inevitable factor. White spot lesion is prime concern for orthodontists. Oral hygiene maintenance and demineralization prevention remains the gold standard strategy.

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Journal of Chemical Health Risks

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