SMU
Sikkim Manipal University
Manipal
INSPIRED BY LIFE
SMU Medical Journal
ISSN : 2349 – 1604 (Volume – 3, No. 1, January 2016) Res. article
Indexed in SIS (USA), ASI (Germany), I2OR & i-Scholar (India) and SJIF (Morocco) databases
Impact Factor: 3.835 (SJIF)

Incidences of White Spot Lesion during Fixed Orthodontic Treatment

Shubhangi A. Mani [1], Ankita A. Sawant [2]

Dept. of Orthodontics, Rural Dental College, Pravara Institute of Medical Sciences, Loni, Tal-Rahata, Ahmadnagar, Maharashtra, India, 1-Professor, 2-Post Graduate student

Corresponding author:
Prof. (Dr.) Shubhangi A. Mani
Dept. Of Orthodontics, Rural Dental College,
Pravara Institute of Medical Sciences, Loni, Tal-Rahata, Dist-Ahmadnagar, Maharashtra, India-413736.

Manuscript received : 24.09.2015
Manuscript accepted: 27.10.2015

Abstract

Development of white spot lesion (WSL) is one of the main side effects of fixed orthodontic treatment. The aim of this study was to investigate the incidence of WSL during treatment and to determine the significant factors.150 patients (78 girls, 72 boys) were randomly selected to determine incipient WSL development. Labial surfaces on pretreatment and posttreatment photographs were scored with a standardized visual scoring system.The prevalence of WSL is 21% before treatment. After treatment, 65% of patients presented

WSL. The incidence of patients who developed at least one new WSL during treatment was 55%. Only 35% of patients were free of WSL all the time. Age at start of treatment and oral hygiene were significantly associated with new WSL development (p=0.004 and p=0.018, respectively). Gender and treatment length were not associated with new WSL development. **Conclusion:** The incidence of WSL in patients treated with Fixed Appliance Treatment was significantly high, and it appeared that the preventive therapies were insufficient. Clinicians should evaluate the oral hygiene status of patients and if possible, should not begin treatment at an early age.

Key Words: Incidence, Prevalence, White Spot Lesions

Introduction

White spot lesions (WSL) are among the most undesired side effects of fixed orthodontic treatment (Figure 1), and estimates of the prevalence of WSL arising during fixed orthodontic treatment range widely from 2% to 96% [1,2,3,4,5,6,7,8]. Orthodontic patients are more susceptible to the development of WSL than untreated patients [9,10], because they carry brackets, bands, and different types of archwires for a long time, which impair oral hygiene and increase plaque retention sites [1,2,11,12]. As a result of plaque accumulation, the oral environment can be prepared for enamel demineralization [13, 14,15].

Figure 1: White Spot lesions after removal of Orthodontic Brackets.

If adequate amount of salivary or plaque calcium, phosphate ions, and fluoride ions are present in the oral environment, they can promote remineralization and prevent WSL [16]. However, it is generally accepted that fluoride reduces the rate of demineralization; fluoride treatment might be insufficient on the bacterially produced lower pH conditions [17]. In

contemporary bonding systems, fluoride-releasing bonding materials were introduced, but these materials seem to have minimal or no positive effect on enamel demineralization [18,19].

In general dentistry, several approaches were previously described for detection of WSL, including fiber-optic transillumination, ultraviolet-light application, fluorescent-dye uptake, and laser fluorescence [20]. However, photographic images are used routinely in orthodontic clinics; therefore, it seems to be the simplest and most clinically relevant approach for detection of WSL. It was reported that the using photographic image analysis systems and photographic image to measure WSL [21, 22].

There is no consensus on which sex is more inclined to WSL incidence: one study found that female patients have a higher incidence of WSL, another found that male patients have higher incidence [9], and a third study found no significant differences in WSLs incidence [19].

Even though it was known that long treatment period, poor oral hygiene, unconscious patient are more suspect, not enough quantitative studies have supported this intervention [1, 2,3,8,11]. The present study was designed to investigate the effect of gender, treatment period, age at start of treatment, and oral hygiene on the incidence of WSL.

Materials and Methods

150 patient records were randomly selected from patients treated in the Dept. of Orthodontics at the Rural Dental College between 2012 and 2014. Inclusion criteria for record selection consist of patients who (1) underwent fixed orthodontic treatment (FOT) with full fixed appliances; (2) had no hypodontia and extraction treatment; (3) had both complete initial and final series of intraoral photographs in the same format; (4) had no dental structural abnormalities or frontal fillings, veneers, or other reconstructions; and (5) had enough quality records.

Oral hygiene score was determined from the doctors' evaluation notes of the patient. If the

patient had bleeding after brushing, the patient was assessed as having poor oral hygiene. If the patient had no bleeding, the patient was assessed as having good oral hygiene.

The patient's date of birth, gender, treatment-beginning date, treatment period, and hygiene score were determined, and groups were separated by these determinations. WSL scoring was done from first molar to other first molar for both jaws. Routine clinical photographs were collected to examine the WSL score. The examination and scoring were done by 2 examiners at separate times. Because there was no consensus on the WSL scoring of 6 patients, they were excluded from the study. The following modified WSL scoring system introduced by Gorelick *et al*. [1] was used for the visual examination:

- Score 0 = no white spot formation,
- Score 1 = mild white spot formation,
- Score 2 = severe white spot formation, and
- Score 3 = white spot formation with cavitation.

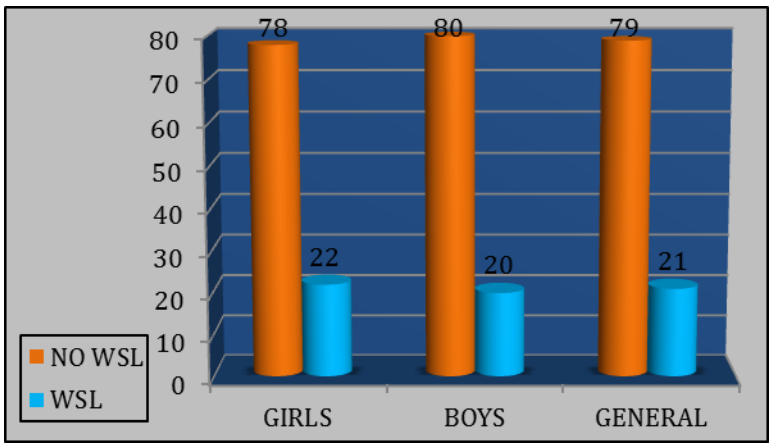
Statistical Analysis

The increasing WSL index before and after treatments was determined. Because the scoring system was used for determination, nonparametric tests were used for statistical analysis. Descriptive statistics were obtained for all groups. Qualitative data were compared by using kappa test. A p value < 0.05 was considered statistically significant.

Results

A histogram of the prevalence of WSL before orthodontic treatment is shown in Graph 1. The overall prevalence of patients who have at least 1 WSL before orthodontic treatment was 21% (n=32). The prevalence of WSL in girls is 22%, in boys 20%, and there is no difference between girls and boys (p=0.686). Only mild WSL formation was observed in initial records. After FOT, 35% (32% girls and 39% of boys) of patients were free of WSL, and the remaining patients (65%) showed WSL with various degrees of severity (3). Of all patients, 35% had only mild WSL, and the remaining WSL patients were affected severely, either with severe (25%) WSL or with cavitation (5%). There were no differences between girls and boys (p=0.468). (Graph 2)

Graph 1- Prevalence of white spot lesions before treatment.



Graph 2- Prevalence of white spot lesions and severity scores before treatment and after treatment (kappa=0.051).

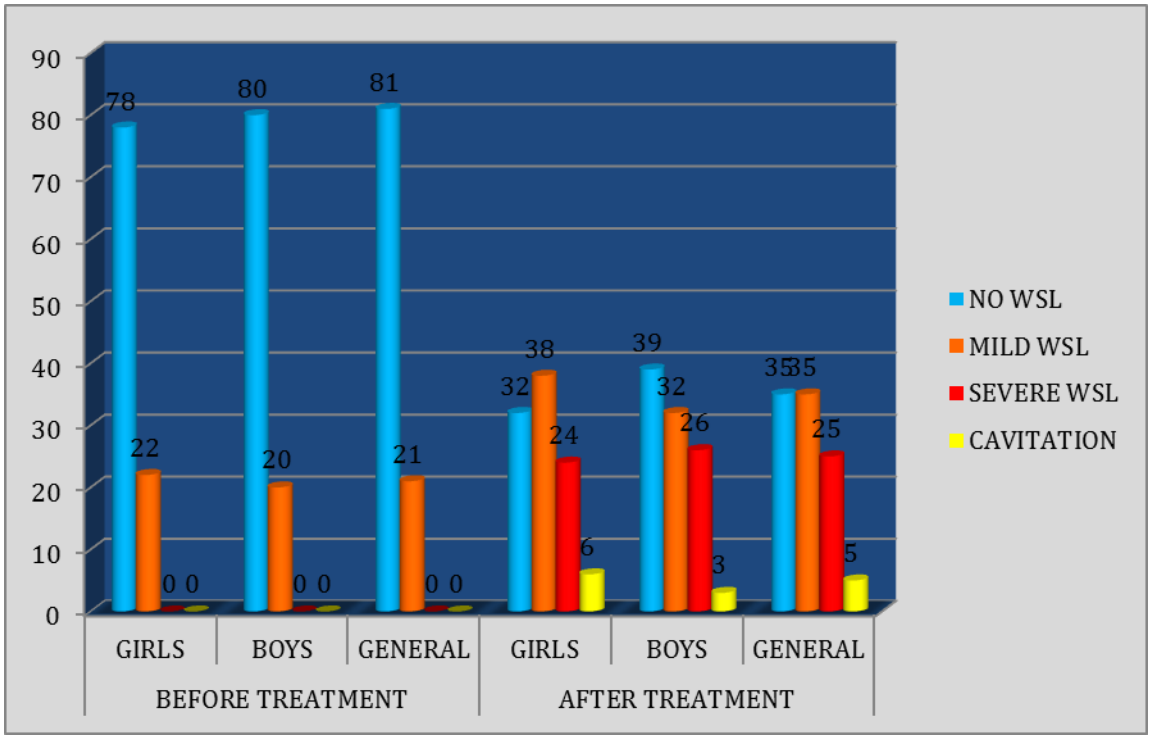


Table 1 presents the relationship between the development of WSL score and the independent variables. Demographic variables of gender and treatment length were not significantly related to the development of new WSL and the severity of WSL (p=0.412 and p=0.086, respectively); however, age at the start of treatment and oral hygiene were significantly

related to the development of new WSL and the severity of WSL (p=0.004 and p=0.018, respectively).

Table 1. Descriptive statistics and incidences on new white spot lesion score values

Independent Variables	No	Mean	SD	Min-Max	P Value
Sex					0.412
Female	78	4.08	4.32	0-19	
Male	72	3.21	4.12	0-16	
Age Group (year)					0.004
10-12	28	5.46	5.12	0-19	A
12-14	48	4.32	3.86	0-17	AB
14-16	52	3.04	2.93	0-12	BC
16-18	22	1.46	1.8	0-6	C
Hygiene Score					0.018
Poor	84	5.04	4.46	0-19	
Good	66	1.92	2.25	0-8	
Treatment Length (months)					0.086
12-14	108	3.97	3.08	0-19	
14-16	42	2.88	2.45	0-12	

Discussion

In the present study, we aimed at analyzing the effect of gender, age at start of treatment, oral hygiene care, and treatment length for orthodontic patients on the prevalence and incidence of WSL. Unfortunately for this retrospective study, no information on patients' socioeconomic status, frequency of consulting the dental clinic, or prophylactic fluoride therapy was available.

The use of intraoral photographs with or without computer-assisted image analysis for WSL determination in orthodontic patients is a well-accepted method [8,10,23,24]. The standardized initial and final FOT photographs have been taken routinely in orthodontic clinics. This digital system has many advantages: records are permanent, and they can be examined later and reexamined multiple times; photographs can be digitized and classified independently by many examiners; and the severity of the lesion can be measured by

measuring the degree of colors [25]. However, determining the WSL scores by photograph may not be entirely accurate because lighting, angulation, and magnification may vary at different time points [26]. Controlling these factors will make the photographic records sound for longitudinal study. Fortunately, a professional photographer with a reliable standard procedure took all photographs evaluated in this study.

The simplest semiquantitative classification system, which had been introduced by Gorelick *et al*. [1] was chosen for the evaluation of WSL incidences. The original or modification of this scoring system is commonly used for evaluation of WSL [8,10,28,29]. In orthodontic literature, several studies on WSL used intraoral photographs for caries determinations. These reports, however, showed large variations in the incidence of WSL. These variations might have been due to the different methods or severe modification of the main scoring system [29]. Therefore we followed the main scoring system.

In cross-sectional design, Gorelick *et al*. [1] compared orthodontically treated patients with untreated controls. Tufekci *et al*. [28] compared orthodontic patients in control and treatment group at 6 and 12 months into treatment by control group. These studies reported on the prevalence of WSL in 2 or 3 groups. Our study was designed to report the true incidence of labial lesions by comparing the same 150 patients longitudinally at 2 time points.

The prevalence of WSL in a control group or before treatment as reported in the literature is between 11%[29] and 24%[1]. The present study is consistent with these studies (21%). In contrast, Mizrahi [2], Ogaard [9] and Pancherz & Mühlich [7] reported much higher WSL prevalence before treatment (from 70.4% to 85%).

The WSL incidence in our study was 55% (59% for girls and 51% for boys), resulting in a WSL prevalence of 65%. Enia *et al*. [10] found incidence of WSL to be 60.9% and prevalence of WSL 73.5% after treatment, but they were assessing only four incisor teeth. Gorelick *et al*. [1] using the same WSL index, reported a WSL incidence of 49.6% during Fixed Treatment. Thus, the incidence and prevalence after treatment in our study were

consistent with the literature, indicating that the general prophylactic procedures used in the past were obviously insufficient to prevent WSL in an adequate percentage of patients.
All WSL patients had mild lesions before treatment and more than half of WSL patients had mild lesions after treatment. Almost all other investigators who observed WSL before and after fixed orthodontic treatment reported similar findings [1,2,3,4,5,6]. Generally all studies and also present study prevalence or incidence designed to determine WSL in same clinic especially in university [27]. Therefore, they do not include too much variation such as geographic and socioeconomic status.

Although age at start of treatment and patient oral hygiene were significant factors, gender and treatment length were not significant factors in WSL development according to the present study. Richter *et al*. [27] determined that age at start of treatment and the patient's oral hygiene were significant factors in WSL development, consistent with the present study. In contrast, we determined that treatment length was not a significant factor in WSL development.

It has been reported that use of prophylactic fluoride during orthodontic treatment might inhibit WSL development [24,30,31]. The lack of present study was deficient of fluoride chart information.

Orthodontic clinicians and training programs should put greater effort in preventing the WSL that most orthodontic patients experience. Despite the high incidence of WSL associated with fixed treatment, fortunately relatively few of these lesions progress so fast that, the Fixed Treatment has to be finished early and insufficiently or upon removal of the orthodontic appliances, a restoration is indicated. If preventive dental care, supporting fluoride therapy, excellent oral hygiene care do not pervade, the scientists will continue make study about WSL.

Conclusion

By using only standardized general photographic records, this study showed a high incidence of newly developed WSL (55%) in patients treated with comprehensive Fixed

Orthodontic Treatment. Although gender and treatment length were not associated with WSL development, a significant association was evidenced with age at start of treatment and oral hygiene.

References

[1] Gorelick L, Geiger AM, Gwinnett AJ. (1982) Incidence of white spot formation after bonding and banding. *Am J Orthod* 81, 93–98.

[2] Mizrahi E. (1982) Enamel demineralization following orthodontic treatment. *Am J Orthod*. 82, 62–67.

[3] Artun J, Brobakken BO. (1986) Prevalence of carious white spots after orthodontic treatment with multibonded appliances. *Eur J Orthod* 8,229–234.

[4] Geiger AM, Gorelick L, Gwinnett AJ, Griswold PG. (1988) The effect of a fluoride program on white spot formation during orthodontic treatment. *Am J Orthod Dentofacial Orthop* 93,29–37.

[5] Mitchell L. (1992) Decalcification during orthodontic treatment with fixed appliances—an overview. *Br J Orthod* 19,199–205.

[6] Wenderoth CJ, Weinstein M, Borislow AJ. (1999) Effectiveness of a fluoride-releasing sealant in reducing decalcification during orthodontic treatment. *Am J Orthod Dentofacial Orthop* 116, 629–634.

[7] Pancherz H, Mühlich DP. (1997) Entwicklung von Karies bei Kieferorthopadischer Behandlung mit festsitzenden Apparaturen—ein Vergleich von Zahnen mit und ohne Kariesvorschädigungen. *Kieferorthop* 11, 139–144.

[8] Akin M, Basciftci FA. (2012) Can white spot lesion be treated effectively. *Angle Orthod* 82, 770–775

[9] Ogaard B. (1989) Prevalence of white spot lesions in 19-year-olds: a study on untreated and orthodontically treated persons 5 years after treatment. *Am J Orthod Dentofacial Orthop* 96, 423–427.

[10] Enia M, Bock N, Ruf S. (2011) White-spot lesions during multibracket appliance treatment: a challenge for clinical excellence. *Am J Orthod Dentofacial Orthop* 140, e17–e24.

[11] Artun J, Thylstrup A. (1989) A 3-year clinical and SEM study of surface changes of carious enamel lesions after inactivation. *Am J Orthod Dentofacial Orthop* 95, 327–333.

[12] Chang HS, Walsh LJ, Freer TJ. (1997) Enamel demineralization during orthodontic treatment: aetiology and prevention. *Aust Dent J.* 42, 322–327.

[13] Balenseifen JW, Madonia JV. (1970) Study of dental plaque in orthodontic patients. *J Dent Res* 49, 320–324.

[14] Diamanti-Kipioti A, Gusberti FA, Lang NP. (1987) Clinical and microbiological effects of fixed orthodontic appliances. *J Clin Periodontol* 14, 326–333.

[15] Boyar RM, Thylstrup A, Holmen L, Bowden GH. (1989) The microflora associated with the development of initial enamel decalcification below orthodontic bands *in vivo* in children living in a fluoridated water area. *J Dent Res* 68, 1734–1738.

[16] Reynolds EC, Cai F, Cochrane NJ, *et al*. (2008) Fluoride and casein phosphopeptide-amorphous calcium phosphate. *J Dent Res* 87, 344–348.

[17] Rølla G, Øgaard B, Cruz R. (1993) Topical application of fluorides on teeth. New concepts of mechanisms of interaction. *J Clin Periodontol* 20, 105–108.

[18] Derks A, Katsaros C, Frencken JE, Van't Hof MA, Kuijpers-Jagtman AM. (2004) Caries-inhibiting effect of preventive measures during orthodontic treatment with fixed appliances. A systematic review. *Caries Res* 38, 413–420.

[19] Boersma JG, van der Veen MH, Lagerweij MD, Bokhout B, Prahl-Andersen B. (2005) Caries prevalence measured with QLF after treatment with fixed orthodontic appliances: influencing factors. *Caries Res* 39, 41–47.

[20] Angnar-Månsson B, Ten-Bosch JJ. (1987) Optical methods for the detection and quantification of caries. *Adv Dent Res* 1,14–20.

[21] Willmot DR. (1996) Image analysis of enamel demineralization associated with fixed appliances. *Eur J Orthod* 18, 257.

[22] Benson PE, Pender N, Higham SM. (2000) Enamel demineralization assessed by computerized image analysis of clinical photographs. *J Dent.* 28, 319–326.

[23] Featherstone JD. (2003) The caries balance: contributing factors and early detection. *J Calif Dent Assoc*. 31, 129–133.

[24] O'Reilly MM, Featherstone JD. Demineralization and remineralization around orthodontic appliances: an *in vivo* study. (1987) *Am J Orthod Dentofacial Orthop* 92,33–40.

[25] Benson PE. (2008) Evaluation of white spot lesions on teeth with orthodontic brackets. *Semin Orthod.* 14, 200–208.

[26] Ellwood R. (1993) *Dental Enamel Opacities and the Relationship to Dental Caries* [thesis]. Cork, Ireland: University College Cork.

[27] Richter AE, Arruda AO, Peters MC, Sohn W. (2011) Incidence of caries lesions among patients treated with comprehensive orthodontics. *Am J Orthod Dentofacial Orthop*. 139, 657–664.

[28] Tufekci E, Dixon JS, Gunselloy JC, Lindauer SJ. (2011) Prevalence of white spot lesions during orthodontic treatment with fixed appliances. *Angle Orthod*. 81, 206–210.

[29] Travess H, Roberts-Harry D, Sandy J. (2004) Orthodontics. Part 6: risks in orthodontic treatment. *Br Dent J*. 196, 71–77.

[30] Ogaard B, Rolla G, Arends J, Cate JM. (1988) Orthodontic appliances and enamel demineralization. Part 2. Prevention and treatment of lesions. *Am J Orthod Dentofacial Orthop*. 94, 123–128.

[31] Chadwick BL, Roy J, Knox J, Treasure ET. (2005) The effect of topical fluorides on decalcification in patients with fixed orthodontic appliances: a systematic review. *Am J Orthod Dentofacial Orthop* 128, 601–606.

Authors Column

Prof. (Dr.) Shubhangi A. Mani is a senior teacher and researcher in Rural Dental College, Loni, Maharashtra. She has completed 9 years in teaching and about 11 years in research. Her research area is 'Orthodontics and craniofacial surgeries'. She has published many research papers in national & international journals. She is guide and supervisor of the research projects of five MD students. she also has been examiner for P.G university exams at various colleges in maharashtra.

SMU Medical Journal, Volume – 3, No. – 1, January, 2016, PP. 617-627