European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 08, 2020

Treatment Of White Spot Lesions Post Fixed Orthodontic Therapy

Dr.Niha Naveed[1], Dr. Thulasiram[2], Dr. Kannan Sabapathy[3]

[1]Post Graduate, Department of Orthodontics and Dentofacial Orthopaedics
[2] Senior lecturer, Department of Orthodontics and Dentofacial Orthopaedics
[3] Professor and HOD, Department of Orthodontics and Dentofacial Orthopaedics
Sree Balaji Dental College and Hospital

ABSTRACT
White spot lesions are one of the most common iatrogenic consequences of fixed orthodontic therapy, which undermines the ultimate aesthetic outcome of the treatment. bonded or banded fixtures aid in plaque retention thereby enhancing white spot lesions/demineralisation of the tooth surface. accurate and reliable detection of white spot lesions in its earliest stages of enamel demineralisation is very important. the recent developments in the diagnostic aids, would enable the orthodontist to detect and diagnose these lesions and use appropriate preventive measures to promote remineralization and conservation of the tooth structure. Several suggestions have been made in the literature to prevent or minimize the risk of this condition but, to date, no definitive conclusion regarding its management protocol has been made.Therefore, this article reviews the current techniques available to manage white spot lesions after orthodontic therapy.

Keywords: White Spot Lesions; Fixed Orthodontic Treatment*; *Plaque; Demineralization

INTRODUCTION

The initial carious lesions or the "white spot lesions", imply the presence of subsurface area with large amount of mineral loss beneath a relatively intact enamel surface.[1]

Clinically, a white opaque spot is characterised by being softer than the adjacent sound enamel which gets increasingly whiter when air dried. A cross section of the white spot lesion suggests the presence of features of carious enamel revealing that the it is essentially an enamel defect with a relatively intact surface enamel layer and some amount of subsurface damaged caused by the acid formed from plaque on the surface of the tooth. [2]It is also important to differentiate between the incipient lesions from the arrested lesions.The incipient lesions are active lesions under acid attack which is progressive but the arrested lesion do not progress. In vivo ultrastructural studies done by Thylstrup and Fredebo concluded that there were wide variations between active and arrested lesions.[6] "Micro-scars" were seen on active lesions while micro-cavitation was usually seen on arrested lesions.[2]

The fixed orthodontic therapy requires the use of various banded or bonded fixture's (brackets, bondable buttons,tubes etc.) and arch wires which are attached to the surface of the tooth. Thus,WSL's are amongst the most common and undesirable complication which could occur during or after the completion of fixed orthodontic treatment.[3]The accumulation of the debris results in the formation of plaque around the orthodontic brackets, bands and arch wireswhich lead to the production of acid by the bacterial plaque causing white spot lesions or zones of demineralisation of the surface of the tooth. thereby compromising the ultimate aesthetic result of the treatment.

It is discouraging to detect WSL after orthodontic therapy as it undermines the overall aesthetic result.[2] Therefore, this article aims to review the initiation, distribution and the frequency of the white spot lesions and evaluates current methods to manage the enamel demineralisation resulting from the orthodontic treatment.

Prevalence Of White Spot Lesions And Risk Factors

Clinically, WSL's may appear on the 4th week after the start of the fixed orthodontic treatment, and may develop rapidly if there is presence of poor oral hygiene.[4] Although their frequency has been quite variable , ranging from 2% to 97% in various epidemiological studies .[4-7]This is so due to the varied techniques employed in detecting and characterising the lesions , including visual inspection , photographs , optical and fluorescenttechniques such as the Diagnodent, qualitative light induced florescence and digital image fiber-optic transillumination.[6,8]Higher prevalence rates are seen with methods employing the quantitative laser techniques which tend to be more sensitive as compared to the simple visual techniques .On an average , the WSL's are seen in 15.5% - 40% of patients before the fixed orthodontic treatment and in 30-70% during the fixed orthodontic therapy.[6]In a recent meta-analysis, in the 14 studies evaluated for WSL , the incidence rate of new carious lesions that developed during fixed orthodontic therapy was 45.8% with a prevalence rate of 68.4%in patients undergoing orthodontic treatment.[7] Thereby concluding a high and alarming rate of the incidence and prevalence rates of WSL in patients undergoing fixed orthodontictreatment.Therefore, it is necessary for the patients as well as the operators to emphasize on the caries prevention measures.[9]

It is also important to diagnose and record the presence of this lesion by standardized photographic plates ,considering the amount of magnification, exposure time and lighting etc , before the commencement of fixed orthodontic treatment.[4]The presence of WSL before the orthodontic treatment is considered an a risk factor for the development of newer lesions,[5] if there is presence of poor oral hygienerates, excess bonding, long etching time (>15 s), decayed/treated molars, and the duration of treatment being considered other risk factors.[5,10]Richter et al. reported the development of three new lesions in 22 months, with at least five injuries in 33 months of treatment.[11]

Formation And Distribution Of White Spot Lesions

After fixed orthodontic appliances are introduced in the oral cavity, there occurs a major change in the bacterial flora of the plaque, with the presence of acidogenic bacteria in higher concentrations, mainly the Streptococcus mutans and Lactobacilli. Greater rapid progression of caries occurs in patients with fixed orthodontic appliance as the higher concentrations of the bacteria lower the plaque to a greater extent compared to that in other patients.[12]WSLtends to appear after 4 weeks of bracket placement, around the brackets, whereas the regular carious lesions take about 6 months to develop.WSL tend to appear in the gingival area on the buccal aspects near the brackets [13], with the labio-gingival area of lateral incisors as the most common and the maxillary posterior segments as the least common site of occurrence. Gender predilection is also seen for WSL with the males being affected higher than the females. [3]Tufekci et al. reported a sharp increase in the number of WSLs during the first 6 months of treatment, increasing at a slower rate up to 12 months. Thereby necessitating the need for maintenance of oral hygiene during the first month of treatment.[11]

Characteristics Of White Spot Lesions In Enamel

The enamel demineralization defect has a lower mineral distribution in the lesion as in comparison to the adjacent sound enamel and also a lower interprismatic mineral content. The first stage of enamel demineralization is characterized by removal of interprismatic mineral content and in the subsequent stages a well-defined lesion formation occurs which constitutes early caries lesion.[13] These studies have demonstrated that a porous and mineralrich lesion covers an enamel lesion and the morphology differs a little from that of sound enamel while body of the lesion which comprises the subsurface area has low mineral content (10-70 vol.%). The early caries lesion in enamel is characterized by a prominent perikymata pattern and focal holes.[14-15]The main drawback of the numerous experimental techniques is that they are static measurements of caries progression at a particular time period whereas the carious process is time-dependent and is in a constant state of dynamic equilibrium wherein a balance is struck between demineralization and remineralization.

Surface Layer Covering White Spot Lesions

The early investigators who observed the white opaque spots attributed the presence of these lesions to artefacts. They believed that the WSL could be due to sound enamel which has a higher mineral content. These explanations were proved false by subsequent investigations by Langdon et al.[16] Their studies on pressed pellets of HAP demonstrated that subsurface lesion could occur in an acidic gel system with 2 ppm fluoride. They also concluded that organic matrix is not important for subsurface lesion formation, and that neither a preferred crystallite orientation in the enamel prisms nor an uneven ion/mineral distribution in enamel were essential for the formation of a subsurface lesion since these are absent in pressed hydroxyapatites. This is in contrast to earlier reports by Brudevold et al.[17]

Prevention And Management Of White Spot Lesions After Orthodontic Treatment

A multifactorial approach should be designed to manage WSL. The major aim is to prevent demineralisation and formation of biofilm, and usage of methods to induce remineralization of lesions, micro-abrasion, erosion-infiltration, adhesive composite resin restorations, and the bonded facets. After the orthodontic appliance is removed, there is a regression appearance of the WSL due to natural remineralization by the saliva and abrasion by the brushing.[19]The severity of the lesions decides the level of improvementand therefore a delay of 6 months should be there before treating these lesions as recommended by Guzmán-Armstrong et al. [20]

Oral Hygiene Control

A non-cariogenic diet should be suggested to the patient by the operator.They must be educated and motivated to practice , maintain and observe effective oral hygiene . Mechanical plaque control and removal by proper brushing of the tooth surfaces, at least twice daily, with fluoride-containing toothpaste, especially in biofilm retention areas, should be strongly advocated. Patients motivation should be re-evaluated during the recall visits and if required should receive professional cleaning, with the oral hygiene and dietary instructions reiterated. [21-23] The professional prophylactic cleaning tends to reduce the bacterial load, increasing the efficacy of toothbrushing.Professionaltooth cleaning should be advised at least 2 -3 times a year in order to maintain healthy oral tissues, reducing the risk of caries. Mechanical retention of bacteria can also be prevented with the use of fluoridated pastes with progressively finer particles, with the use of polishing cups or brushes. WSL improvement also depends upon the duration of orthodontic treatment, type of tooth involved, and WSL surface area .[24]

Remineralisation

Remineralisation usually takes a long time depending upon the patient motivation of practicing good oral hygiene. Various professionally as well as at home products and methods are available in different forms such as: varnishes, solutions, creams,pastes, and gums. These products mainly comprise of Fluoride or casein phosphopeptide-amorphous calcium phosphate. [4,26,28,33,34]Denis et al. advocated these measures for score of 0 and 1 of these lesions based on the ICDAS classification[32]. Although the lesions with score 2 required the need for professional techniques such as erosion–infiltration,[32-33]bleaching, and microabrasion.[30]Often tooth discolorations are seen with products containing higher concentrations of fluoride and are therefore not recommended. Further well-designed trials are needed to support the remineralizing techniques with reliablescientific data.[36]

Bleaching

Bleaching often results in tooth sensitivity and decreased enamel microhardness and therefore rendering the procedures limited.[37]However a recent study showed camouflage ofWSLwith no effect on the chemical or mechanical properties of the enamel, with the use of 10% carbamide peroxide. In addition the use of casein phosphopeptide-amorphous calcium phosphate was considered as an adjunct treatment for remineralisation in the subsurface lesion.[38]Khoroushi et al. showed in an in vitro study that a gentle, non-invasive bleaching procedure by incorporating three different biomaterials, including nano-BAG, nano-hydroxyapatite, and nano-amorphous calcium phosphate, into bleaching agents might mitigate the negative effects of tooth bleaching

and prevent the irreversible changes in the enamel surface.[39-40] Usually patients with good oral hygiene are participants to this prouder in order to mask the inactive lesions when the natural mineralisation is not complete. [32]

Microabrasion

Microabrasion comprises of a chemical and mechanical processing of the enamel surface by applying an abrasive slurry of 6.6% (Opalustre) or 6% (Whiteness RM) hydrochloric acid with a brush.Due to its greater invasive nature, a delayed application was considered beneficial .[41] The efficacy of this method requires the post orthodontic treatment lesion's depth to be lesser than 0.02 mm.[41-42] is often associated with the bleaching procedures. [43-44]

Erosion – Infiltration

A low viscosity resin, infiltrated in the WSL is a less invasive recent treatment modality for the post orthodontic white spot lesions. The etching of the outer surface is facilitated by the use of HCl which renders it more permeable, thereby infiltrating the underlying porous structure with the use of a triethylene glycol dimethacrylate-based resin.[45] The procedure involves etching done for 20s using 15% HCl, followed by rinsing, drying and dehydrating with ethanol. This resin successfully camouflages the WSL as its refractive index lies close to that of the sound enamel. It also successfully reinforces the compromised prism enamel structure. [46] The depth of the lesion defines the amount of camouflage effect that has occurred. This treatment when done do early active lesions is more effective than the lesions at inactive stage.[5,47] since this is a fairly newer technique, there isn't much clinical experience available in relation to the orthodontic WSL's. An in vitro study by Yetkiner evaluated the colour improvement and stability of WSLs following infiltration, fluoride, or microabrasion treatments and reported that infiltration and microabrasion decreased the whitish appearance of WSLs. Only infiltrated WSLs were stable after a discoloration challenge.[48]

CONCLUSION

The occurrence of WSL around the orthodontic fixtures during and specially after the treatment is quite common. These lesions can be managed and prevented by proper educating and motivating the patient to maintain good oral hygiene. Additionally, regular professional prophylactic measure is also important. Other methods including the CPP-ACP, sealants, lasers, tooth bleaching, resin infiltration and microabrasion are also recommended. Although the most important prophylactic measure is the habit of maintaining good oral hygiene in fixed orthodontic patients to prevent WSL'S.

REFERENCES

1. Kleter GA. Discoloration of dental carious lesions (a review). Arch Oral Biol1998;43:629-32.
2. Zabokova-Bilbilova E, Popovska L, Kapusevska B, Stefanovska E. White spot lesions: Prevention and management during the orthodontic treatment. Pril (MakedonAkadNaukUmet Odd Med Nauki) 2014;35:161-8.
3. Chapman JA, Roberts WE, Eckert GJ, Kula KS, González-Cabezas C. Risk factors for incidence and severity of white spot lesions during treatment with fixed orthodontic appliances. Am J Orthod Dentofacial Orthop2010;138:188-94.
4. Bishara SE, Ostby AW. White spot lesions: Formation, prevention, and treatment. Semin Orthod2008;14:174-82.
5. Heymann GC, Grauer D. A contemporary review of white spot lesions in orthodontics. J EsthetRestor Dent 2013;25:85-95.
6. Julien KC, Buschang PH, Campbell PM. Prevalence of white spot lesion formation during orthodontic treatment. Angle Orthod2013;83:641-7.
7. Sangamesh B, Kallury A. Iatrogenic effects of orthodontic treatment – Review on white spot lesions. Int J Sci Eng Res 2011;2:2-16.
8. Pretty IA. Caries detection and diagnosis: Novel technologies. J Dent 2006;34:727-39.

9. Sundararaj D, Venkatachalapathy S, Tandon A, Pereira A. Critical evaluation of incidence and prevalence of white spot lesions during fixed orthodontic appliance treatment: A meta-analysis. J Int Soc Prev Community Dent 2015;5:433-9.
10. Khalaf K. Factors affecting the formation, severity and location of white spot lesions during orthodontic treatment with fixed appliances. J Oral Maxillofac Res 2014;5:e4.
11. Richter AE, Arruda AO, Peters MC, Sohn W. Incidence of caries lesions among patients treated with comprehensive orthodontics. Am J Orthod Dentofacial Orthop2011;139:657-64.
12. Lundström F, Krasse B. Streptococcus mutans and lactobacilli frequency in orthodontic patients; the effect of chlorhexidine treatments. Eur J Orthod1987;9:109-16.
13. Mattousch TJ, van der Veen MH, Zentner A. Caries lesions after orthodontic treatment followed by quantitative light-induced fluorescence: A 2-year follow-up. Eur J Orthod2007;29:294-8.
14. Mizrahi E. Enamel demineralization following orthodontic treatment. Am J Orthod1982;82:62-7. 15. Yagci A, Korkmaz YN, Buyuk SK, Yagci F, Atilla AO. White spot lesion formation after treatment with full-coverage rapid maxillary expanders. Am J Orthod Dentofacial Orthop2016;149:331-8.
16. Tufekci E, Dixon JS, Gunsolley JC, Lindauer SJ. Prevalence of white spot lesions during orthodontic treatment with fixed appliances. Angle Orthod2011;81:206-10.
17. Morrier JJ. White spot lesions and orthodontic treatment. Prevention and treatment. Orthod Fr 2014;85:235-44.
18. Sudjalim TR, Woods MG, Manton DJ. Prevention of white spot lesions in orthodontic practice: A contemporary review. Aust Dent J 2006;51:284-9.
19. Harvey WJ, Powell KR. Care of dental enamel for the orthodontic patient. AustOrthod J 1981;7:70-6
20. Øgaard B. Oral microbiological changes, long-term enamel alterations due to decalcification, and caries prophylactic aspects. Orthodontic Materials Scientific and Clinical Aspects. Stuttgart: Thieme; 2001. p. 123-42.
21. Kim S, Katchooi M, Bayiri B, Sarikaya M, Korpak AM, Huang GJ. Predicting improvement of postorthodontic white spot lesions. Am J Orthod Dentofacial Orthop2016;149:625-33.
22. Davidson CL, Bekke-Hoekstra IS. The resistance of superficially sealed enamel to wear and carious attack in vitro. J Oral Rehabil1980;7:299-305.
23. Marinho VC. Cochrane reviews of randomized trials of fluoride therapies for preventing dental caries. Eur Arch Paediatr Dent 2009;10:183-91.
24. Walsh T, Worthington HV, Glenny AM, Appelbe P, Marinho VC, Shi X. Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2010;1:CD007868.
25. Al-Mulla A, Karlsson L, Kharsa S, Kjellberg H, Birkhed D. Combination of high-fluoride toothpaste and no post-brushing water rinsing on enamel demineralization using an in-situ caries model with orthodontic bands. Acta OdontolScand2010;68:323-8.
26. Bergstrand F, Twetman S. A review on prevention and treatment of post-orthodontic white spot lesions – Evidence-based methods and emerging technologies. Open Dent J 2011;5:158-62.
27. Feng CH, Chu XY. Efficacy of one year treatment of icon infiltration resin on post-orthodontic white spots. Beijing Da XueXue Bao 2013;45:40-3.
28. Bahoum A, Bahije L, Zaoui F. Enamel demineralization in orthodontics. Systematic use of fluoride in prevention and treatment. Schweiz MonatsschrZahnmed2012;122:937-47.
29. Benson PE, Parkin N, Dyer F, Millett DT, Furness S, Germain P. Fluorides for the prevention of early tooth decay (demineralised white lesions) during fixed brace treatment. Cochrane Database Syst Rev 2013;12:CD003809.
30. Benson PE, Parkin N, Millett DT, Dyer FE, Vine S, Shah A. Fluorides for the prevention of white spots on teeth during fixed brace treatment. Cochrane Database Syst Rev 2004;3:CD003809.
31. Srivastava K, Tikku T, Khanna R, Sachan K. Risk factors and management of white spot lesions in orthodontics. J Orthod Sci 2013;2:43-9.
32. Benson PE, Pender N, Higham SM. Quantifying enamel demineralization from teeth with orthodontic brackets – A comparison of two methods. Part 2: Validity. Eur J

Orthod2003;25:159-65. 33. Marinho VC, Worthington HV, Walsh T, Clarkson JE. Fluoride varnishes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2013;7:CD002279.
34. Azarpazhooh A, Limeback H. Clinical efficacy of casein derivatives: A systematic review of the literature. J Am Dent Assoc 2008;139:915-24.
35. Vivaldi-Rodrigues G, Demito CF, Bowman SJ, Ramos AL. The effectiveness of a fluoride varnish in preventing the development of white spot lesions. World J Orthod2006;7:138-44.
36. Perrini F, Lombardo L, Arreghini A, Medori S, Siciliani G. Caries prevention during orthodontic treatment: In-vivo assessment of high-fluoride varnish to prevent white spot lesions. Am J Orthod Dentofacial Orthop2016;149:238-43.
37. Kirschneck C, Christl JJ, Reicheneder C, Proff P. Efficacy of fluoride varnish for preventing white spot lesions and gingivitis during orthodontic treatment with fixed appliances-a prospective randomized controlled trial. Clin Oral Investig2016;20:2371-8.
38. Turner PJ. The clinical evaluation of a fluoride-containing orthodontic bonding material. Br J Orthod1993;20:307-13.
39. Banks PA, Burn A, O'Brien K. A clinical evaluation of the effectiveness of including fluoride into an orthodontic bonding adhesive. Eur J Orthod1997;19:391-5.
40. Millett DT, McCluskey LA, McAuley F, Creanor SL, Newell J, Love J. A comparative clinical trial of a compomer and a resin adhesive for orthodontic bonding. Angle Orthod2000;70:233-40.
41. Marcusson A, Norevall LI, Persson M. White spot reduction when using glass ionomer cement for bonding in orthodontics: A longitudinal and comparative study. Eur J Orthod1997;19:233-42.
42. Vahid-Dastjerdi E, Borzabadi-Farahani A, Pourmofidi-Neistanak H, Amini N. An in-vitro assessment of weekly cumulative fluoride release from three glass ionomer cements used for orthodontic banding. Prog Orthod2012;13:49-56.
43. Norevall LI, Marcusson A, Persson M. A clinical evaluation of a glass ionomer cement as an orthodontic bonding adhesive compared with an acrylic resin. Eur J Orthod1996;18:373-84
44. Khoroushi M, Keshani F. A review of glass-ionomers: From conventional glass-ionomer to bioactive glass-ionomer. Dent Res J (Isfahan) 2013;10:411-20.
45. Banks PA, Chadwick SM, Asher-McDade C, Wright JL. Fluoride-releasing elastomerics – A prospective controlled clinical trial. Eur J Orthod2000;22:401-7.
46. Mattick CR, Mitchell L, Chadwick SM, Wright J. Fluoride-releasing elastomeric modules reduce decalcification: A randomized controlled trial. J Orthod2001;28:217-9.
47. Miethke RR. Comment on determination of fluoride from ligature ties. Am J Orthod Dentofacial Orthop1997;111:33A.
48. Burbank BD, Slater M, Kava A, Doyle J, McHale WA, Latta MA, et al. Ion release, fluoride charge of and adhesion of an orthodontic cement paste containing microcapsules. J Dent 2016;45:32-8.