Tikrit Journal for Dental Sciences 12(1) (2024) 135-142
https://doi.org/10.25130/tjds.12.1.14

Tikrit Journal
for
Dental Sciences
https://tjds.tu.edu.iq
ISSN:2073-1213

Enamel White Spot Lesions: A Review of Etiology, Prevention, and Treatment

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Keywords:
Bioactive Glass, Microabrasion, Resin Infiltration, White Spot Lesion.

Article Info.:

Article History:
Received: 5/6/2023
Received in revised form: 13/6/2023.
Accepted: 15/6/2023
Final Proofreading: 15/6/2023
Available Online: 1/6/2024

Citation: **Chabuk MG, Al-Shamma AM. Enamel White Spot Lesions: A Review of Etiology, Prevention, and Treatment. Tikrit Journal for Dental Sciences 2024; 12(1): 135-142**

https://doi.org/10.25130/tjds.12.1.14

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Abstract

Enamel White Spot Lesions (EWSLs) are a common dental condition characterized by being opaque or chalky white in appearance. In this review, an overview of the etiology, prevention, and treatment techniques for EWSLs is presented. Enamel demineralization caused by bacteria in dental plaque which releases acids upon the consumption of fermentable carbohydrates causing mineral loss is thought to be the main cause of those lesions, which could be predisposed through orthodontic treatment, poor diet, inadequate oral hygiene and certain medical conditions. So, sustaining an adequate carbohydrate consumption, proper fluoride exposure and good oral hygiene are some of the practices which aid in these lesions' prevention. Although the success or failure of treatment of EWSLs depends on patient cooperation, depth of the lesion and lesion severity, treatment of those EWSLs should begin with the most conservative approach like remineralization and if failed then more invasive microabrasion, infiltration and maybe even restoration treatment strategies can be pursued. Further research is still needed in the prevention and treatment strategies.

Introduction:

The earliest clinical sign of the dental caries process manifestes as a white chalky lesion on the enamel surface, that could be observed with the naked eye and intensifies when the tooth is carefully dried. This condition is known as Enamel White Spot Lesion (EWSL). Its pathogenesis may be various. The main cause is related to a

prolonged plaque accumulation; moreover, many other factors as diet and levels of calcium, phosphate, bicarbonate, fluoride in saliva as well as genetic factors are reported (1).

Enamel White Spot Lesions occur when the organic acids produced by the pathogenic bacteria have leached out a certain amount of calcium and phosphate ions. These ions may or may not be compensated by the natural remineralization process. After only one week of undisturbed biofilm formation, studies have shown a slight increase in enamel porosity, and the tissue beneath the porous outer microsurface was more porous than the microsurface itself. This so-called subsurface demineralization became more obvious at weeks 2, 3, and 4, and the classic histological zones of the white-spot lesion in polarized light could be identified (2). Lesions that are still present after 6 months are likely to remain without any further size reduction, becoming an esthetic concern for young patients. Compared to sound enamel, EWSLs are clinically observed on the labial surface of anterior teeth. In posterior teeth EWSLs develop in the interproximal contact area as incipient class II lesions (3).

In general, treatment of EWSLs should begin with the most conservative approach. If such approaches do not resolve the problem, then more aggressive treatment modalities can be pursued if the patient desires (4). Successful treatment of those lesions requires a good diagnostic plan, which could be assisted with proper visualization, x-rays, transillumination, and photographs (5, 6) .

Microabrasion is a form of treatment used to treat EWSLs which could improve teeth aesthetic by eliminating the outer defective enamel layer. This invasive technique involves hydrochloric acid and silicon carbide microparticles to remove superficial parts of the lesion (7, 8).

Another way of treating EWSLs is through the use bioactive glass particulates, its active ingredient, inorganic calcium sodium phosphocilicates when comes in contact with saliva or any aqueous media, binds to the tooth surface in order to initiate the remineralization process on the tooth enamel (9).

Recently, a noninvasive alternative treatment was proposed, based on caries infiltration with a hydrophobic resin, which has a refractive index close to that of sound enamel, therefore masking the white spot by infiltrating the porous enamel. This treatment has also been proposed to inhibit demineralization because the diffusion pathways for cariogenic acids are blocked, therefore sealing the white spot lesions. The infiltrant resin is a product that allows for the treatment of carious lesions in early stages without invasive measures (10).

Methods\Search Strategy

Google scholar and pubMed database were the websites used in the comprehensive electronic search which have assisted the reference gathering of this review article together with a manual search of the needed references. The accredited keywords used were: bioactive glass, microabrasion, resin infiltration and white spot lesion, which were utilized in the manuscript gathering process. Excluded articles included the following: unrelated articles, articles not published in high ranked journals, social media, personal assumptions and points of view. This article included 48 references.

Classification of Enamel White Spot Lesions

There are two main types of enamel white lesions which are: fluorosis which is a not well defined, smooth, non-carious, and shiny form of white lesions with a symmetrical distribution throughout teeth Fig.(1-A) , while the other type of enamel lesions are the well-defined carious EWSLs, known to be rough and porous with an opaque discoloration and a random distribution throughout the oral cavity Fig.(1-B) (1, 4).

Etiology of Enamel White Spot Lesions

A combination of factors could contribute to the development of EWSLs. The main etiological factors include:

1. Dental Plaque: Improper oral hygiene practices can lead to plaque accumulation on the tooth surfaces, bacteria in dental plaque (Streptococcus mutans) metabolizes fermentable carbohydrates consumed through diet, releasing acids as byproducts, this acid production causes a pH drop in the oral cavity then minerals will be leached out from the enamel surface (calcium and phosphate mainly) leading up to the development of WSLs (6).
2. Traumatic hypo mineralization: any traumatic incidents during pre, peri or post-natal conditions, could lead to hypo mineralization during tooth development, which could be the cause of EWSLs (11).
3. Natural EWSLs: less than 0.5 mm isolated lesions could be found naturally on the labial surfaces of incisors (11).
4. Fluoride Exposure: Inadequate or excessive exposure to fluorides during tooth development increases the risk of EWSLs (4).
5. Orthodontic Treatment: EWSLs are a common side effect to orthodontic treatment, due to the presence of brackets and wires acting as plaque stagnation areas making oral hygiene more challenging, leading up to the formation of EWSLs (12).

Properties of Enamel White Spot Lesions

Enamel White Spot Lesions possess certain characteristic properties. It lies most frequently on the labial and buccal surfaces of teeth but it could also be found interproximally (3). The color of those lesions is opaque white and could be easily distinguished from the surrounding normal enamel, it is presumably attributed to the fact that during the demineralization process, the enamel pores increase in size, harboring more air and water which has different refractive indices than that of enamel, giving it it's characteristic opaque white discoloration (13). Because of the demineralization process caused by organic acids, these EWSLs with time get to become rougher with reduced hardness, more porous or irregular surface quality compared with the surrounding smooth healthy enamel. Their composition is also distinct from the healthy enamel due to the calcium and phosphate mineral loss during the demineralization process (14, 15).

Prevalence and incidence of Enamel White Spot Lesions

Increased incidences of EWSLs have been documented in the recent years in patients undergoing orthodontic treatment because of the presence of more retentive zones than usual with those patients (12).

A minimum of one EWSL was discovered in 50% of orthodontically treated individuals opposing a percentage of 24% of non-treated individuals (16), 72.9% of orthodontic patients in a study by Richter et al. (17) was also found to have developed at least one EWSL.

A larger percentage of males (three times more) are speculated to have developed at least one EWSL than females, with 40% of their buccal surfaces involved to a 24% of that in females (12).

One study by Axelsson et al., found a higher risk of EWSLs in 11 to 14 years aged children, and another study by Enaia et al. found a 12 to 16 years old higher EWSL tendency, while no age relation was found in other studies (18) (19, 20)

Mechanism of development of Enamel White Spot Lesions

When bacteria found in dental plaque consumes its nutritional source that is fermentable carbohydrates, organic acids are released leading to a pH drop to 5.5, and if this pH is maintained; the demineralization procedure then begins. Any increase in the pH level to greater than

5.5 reverts the process into a remineralization one (21). Enamel hydroxyapatites during the demineralization process gets dissolved developing microporosities leading to form the signature appearance of EWSLs (22). The opposite of this process is the remineralization process where calcium and phosphate minerals found in saliva cause the repairing process of restoring the dissolved ionic component of EWSLs forming a more acid resistant enamel surface (23).

Prevention of Enamel White Spot Lesions

Prevention of EWSLs could be ensued by implementing a proper oral hygiene routine to fight the development of EWSLs, this could be maintained with the help of fluoridated toothpastes (amine fluoride, sodium fluoride, stannous fluoride , monofluorosphosphate or a combination of these) as fluoride aids in promoting EWSL remineralization with a plaque inhibiting anticaries effect (4, 24). A 1500 – 5000 ppm fluoride concentration in toothpastes and gels documented a great success in inhibiting enamel demineralization (25). In patients receiving orthodontic treatment, the use of fluoride containing sealants and adhesive systems around brackets is beneficial. Mouth washes containing zin, triclosan, chlorohexidine have antibacterial effect and have been also successful in preventing the development of EWSLs (26). Through the use of MI paste plus, which is a product containing fluoride, amorphous calcium phosphate (ACP) and casein phosphopeptide (CPP), is a calcium and phosphate supersaturated product which seeps through EWSL porosities performing a remineralization action and ultimately arresting the lesion (27). Another remineralization product containing hydroxyapatite and fluoride called Remin Pro, have been documented to be successful in preventing EWSLs (28). Dietary modification, xylitol, calcium remineralizing agents and chlorohexidine are all used in EWSL prevention due to their action in enamel demineralization deactivation (1).

Treatment options to Enamel White Spot Lesions

Taking into account how much progress a lesion has gone through the enamel surface, the treatment of EWSLs could be classified into early, intermediate and late intervention (29) and the most popular and desired of which is the intermediate minimum intervention dentistry where only minimum amount of tooth structure is destined to removal during the dental treatment (30).

Remineralization treatment

Remineralization is one form of treatment used in the management of EWSLs used in the early stages of these lesions, remineralizing agents come in the form of gels, toothpastes and topical application. This process works in a paradoxical manner to demineralization by slowing or even hindering it, once a remineralizing agent interacts with hydrogen ions forming calcium hydrogen phosphate releasing calcium and phosphate into the environment and increasing the levels of pH by slowing down the acid dissolution (31). Fluoride, calcium sodium phosphosilicate glass, casein phosphopeptide amphorous calcium phosphate (CPP-ACP) and casein phosphopeptide-amorphous calcium phosphate fluoride are some of the materials useful in the remineralization process (32, 33). Once lesion depth is too advanced then remineralization will not solve the issue and more invasive techniques should be pursued (34).

Laser treatment

Laser is a semiconductor device that contains a diode junction through which a laser beam is emitted (35). Laser treatment used with the help of a low energy laser of a 2.94 μm wavelength (erbium laser), which exhibits a fatal effect on the microorganisms, is responsible for the EWSL demineralization. This laser coupled with MI paste (CCP-ACP) have been proven to be effective in the treatment of those lesions (36).

Microabrasion treatment

Microabrasion is a conservative, minimally invasive procedure, and another treatment

option that can be used for enamel white spot lesions by removing the discolored or demineralized enamel and providing a more seamless color masking of the lesion (37). It has been successfully used in dentistry in treating developmental defects, surface irregularities, dental decalcifications, and stubborn discolorations (38).

Microabrasion is performed with the help of a rubber cup attached to a rotating handpiece or a dental drill. It is a mixture of a mild acid (6.6% hydrochloric acid or 37% phosphoric acid) and an abrasive agent (pumice), combining the dissolution of minerals caused by the acid together with mechanical abrasion of the abrasive material, causes the removal of only a thin layer of enamel (20 – 200 µm), then a final polish is performed for a smoother finish (39).

Although microabrasion has been successfully proven to aid in the treatment of EWSLs, it is important to keep in mind that it only works on superficial lesions which have not progressed deep through the enamel surface, deeper lesions on the other hand; may require more extensive types of treatment strategies (direct or indirect types, restorations or maybe even crowns or veneers) (40).

Bioactive glass treatment

Bioactive glass is a material that has the ability to interact with biological tissues, including teeth, and promote remineralization. When bioactive glass is applied to Enamel White Spot Lesions, it releases ions such as calcium, phosphate, and fluoride. These ions can penetrate the enamel and promote the remineralization process by attracting minerals from saliva and aiding in the repair of the demineralized areas. Conventional silicates (45S5), borate based glasses, and phosphate based glasses are some of the bioactive glasses available (41).

BAG 45S5 calcium sodium phospho-silicate glass has been given the brand name NovaMin, which is the type of glass used in dental practice in managing demineralized enamel structure, in dentine desensitization and as a bone alternative in periodontology. Bioactive glass can be applied in the form of a paste, solution, or powder. The material is typically placed directly on the affected area and allowed to interact with the tooth surface. Over time, the bioactive glass encourages the deposition of minerals, strengthening the enamel and improving the appearance of the white spot lesions (42).

The use of bioactive glass in treating enamel white spot lesions is a relatively new approach, and research is still ongoing to determine its long-term effectiveness. However, initial studies have shown promising results in terms of remineralization and lesion improvement (43).

Resin infiltration treatment

Resin infiltration treatment (ICON) is another treatment strategy that is considered to be minimally invasive which is used in the treatment and masking of EWSLs. It is a low viscosity, low molecular weight resin material (triethylene glycol dimethacrylate (TEGDMA)) that seeps through the enamel porosities with a similar refractive index (RI 1.44) to enamel (RI 1.63) leading to not only slowing but also stopping the demineralization procedure together with masking of those lesions (30), also this demineralized unsupported enamel structure is reinforced with the addition of this low viscosity resin in the lesion body making enamel more mechanically durable and acid resistant (30, 44).

This material is a conservative, noninvasive treatment approach consistent of three steps: an etchant step of 15% hydrochloric acid which removes only 58 ± 37 µm of the EWSL surface opening up access to the body of the lesion, a desiccating step for drying purposes, and a final step of resin infiltration allowing the material to seep through the porosities and filling them, which ultimately reduces or maybe even completely masks those lesions (45).

Icon resin infiltration is considered to be a gold standard in the management of EWSLs with a remarkable instant lesion disappearance in mild lesions, with 6 months durability and no changes after 12 to 24 months (46), however a gradual enhancement is observed in moderate lesions when observed over a period of time (47).

Conclusions

The conjecture obtained through this research is that EWSL is a reversible condition that could be reversed at its initial stages, with good oral hygiene, topical fluoride application and the help of remineralizing gels and toothpastes could be used to aid prevent this problem. If deeper, more advanced lesions existed, then more invasive techniques should be employed, some of which are lasers, microabrasion, bioactive glasses and resin infiltration. There is no single material that could be used with the expectation of an ideal outcome, although according to previous studies, ICON resin infiltration could be regarded as the technique with the best outcome compared to others in regard to color masking, conservancy and mechanical durability.

Acknowledgements

This work was supported by the department of Restorative and Aesthetic Dentistry, College of Dentistry, University of Baghdad, Baghdad, Iraq.

Fig. (1) A: Dental fluorosis (48), B: WSLs (3).

References

1. Guzmán-Armstrong S, Chalmers J, Warren JJ. White spot lesions: Prevention and treatment. American Journal of Orthodontics and Dentofacial Orthopedics. 2010;138(6):690-696.

2. Attar IJ, Ghaib NH. The Effect of Some Remineralization Materials and Resin Infiltration (ICON) on the Depth of White Spot Lesions. J Bagh Coll Dent. 2018;30(2).

3. Perdigão J. Resin infiltration of enamel white spot lesions: An ultramorphological analysis. Journal of Esthetic and Restorative Dentistry. 2020;32(3):317-324.

4. Bishara SE, Ostby AW. White spot lesions: formation, prevention, and treatment. Seminars in orthodontics. 2008;14(3):174-182.

5. Diniz MB, Rodrigues JA, Hug I, De Cássia Loiola Cordeiro R, Lussi A. Reproducibility and accuracy of the ICDAS-II for occlusal caries detection. Community dentistry and oral epidemiology. 2009;37(5):399-404.

6. Hussein KM, Al-Shamma AM. Effect of Staining and Brushing on the Surface Roughness of White Spot Lesions Treated with Resin Infiltration Technique. Indian J Public Health Res Dev. 2019;10(10).

7. Pini NI, Costa R, Bertoldo CE, Aguiar FH, Lovadino JR, Lima DANL. Enamel morphology after microabrasion with experimental

compounds. Contemporary Clinical Dentistry. 2015;6(2):170.

8. Bertoldo C, Lima D, Fragoso L, Ambrosano G, Aguiar F, Lovadino J. Evaluation of the effect of different methods of microabrasion and polishing on surface roughness of dental enamel. Indian Journal of Dental Research. 2014;25(3):290.

9. Golpayegani MV, Sohrabi A, Biria M, Ansari G. Remineralization effect of topical NovaMin versus sodium fluoride (1.1%) on caries-like lesions in permanent teeth. J Dent (Tehran). 2012;9(1):68.

10. Meyer-Lueckel H, Paris S. Improved resin infiltration of natural caries lesions. Journal of dental research. 2008;87(12):1112-1116.

11. Sampson V, Sampson A. Diagnosis and treatment options for anterior white spot lesions. BDJ Open. 2020;229(6):348-352.

12. 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. Journal of International Society of Preventive & Community Dentistry. 2015;5(6):433.

13. Cazzolla AP, De Franco AR, Lacaita M, Lacarbonara V. Efficacy of 4-year treatment of icon infiltration resin on postorthodontic white spot lesions. BMJ Case Rep. 2018:225-639.

14. Van der Veen M, de Jong EdJ. Application of quantitative light-induced fluorescence for assessing early caries lesions. Monogr Oral Sci. 2000;17:144-162.

15. Tinanoff N. Dental caries. Pediatric Dentistry: Elsevier; 2019. p. 169-179.

16. Maxfield BJ, Hamdan AM, Tüfekçi E, Shroff B, Best AM, Lindauer SJ. Development of white spot lesions during orthodontic treatment: perceptions of patients, parents, orthodontists, and general dentists. American Journal of Orthodontics and Dentofacial Orthopedics. 2012;141(3):337-344.

17. Richter AE, Arruda AO, Peters MC, Sohn W. Incidence of caries lesions among patients treated with comprehensive orthodontics. American Journal of Orthodontics and Dentofacial Orthopedics. 2011;139(5):657-664.

18. 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):e17-e24.

19. Mizrahi E. Enamel demineralization following orthodontic treatment. American journal of orthodontics. 1982;82(1):62-67.

20. Øgaard B. Prevalence of white spot lesions in 19-near-olds: A study on untreated and orthodontically treated persons 5 years after treatment. American Journal of Orthodontics and Dentofacial Orthopedics. 1989;96(5):423-427.

21. Touger-Decker R, Van Loveren C. Sugars and dental caries. The American journal of clinical nutrition. 2003;78(4):881S-892S.

22. Elhiny O, Salem G. Will resin infiltration with ICON prevent enamel demineralization around orthodontic bracket. Int J Adv Res. 2016;4:1661-7.

23. Selwitz RH, Ismail AI, Pitts NB. Dental caries. The Lancet. 2007;369(9555):51-59.

24. khalil Ibrahim N. Superficial Roughness and Micro Hardness of Nanoparticular Composite Resin Affect by Whitening Dentifrices Contain Optical Agent. Tikrit Journal for Dental Sciences. 2022;10(2).

25. Derks A, Katsaros C, Frencken JE, Van't Hof M, Kuijpers-Jagtman A. Caries-inhibiting effect of preventive measures during orthodontic treatment with fixed appliances. Caries research. 2004;38(5):413-420.

26. Øgaard B, Rolla G, Øgaard B. Oral microbiological changes, long-term enamel alterations due to decalcification, and caries prophylactic aspects. Orthodontic Materials: Scientific and Clinical Aspects Stuttgart, Thieme. 2001:123-142.

27. Tahmasbi S, Mousavi S, Behroozibakhsh M, Badiee M. Prevention of white spot lesions using three remineralizing agents: An in vitro comparative study. Journal of Dental Research, Dental Clinics, Dental Prospects. 2019;13(1):36.

28. Somasundaram P, Vimala N, Mandke LG. Protective potential of casein phosphopeptide amorphous calcium phosphate containing paste on enamel surfaces. Journal of conservative dentistry: JCD. 2013;16(2):152.

29. Jefferies SR. Advances in remineralization for early carious lesions: a comprehensive review. Compend Contin Educ Dent. 2014;35(4):237-243.

30. Kielbassa AM, Mueller J, Gernhardt CR. Closing the gap between oral hygiene and minimally invasive dentistry: a review on the resin infiltration technique of incipient (proximal) enamel lesions. Quintessence international. 2009;40(8).

31. Jumaah SS, Al-Shamma AM. Immediate and Long Term Gingival Marginal Leakage of Two

Bioactive Bulk Fill Restorative Materials (A Comparative in

vitro Study). Journal of Research in Medical and Dental Science. 2021;9(7):120-126.

32. Ballard RW, Hagan JL, Phaup AN, Sarkar N, Townsend JA, Armbruster PC. Evaluation of 3 commercially available materials for resolution of white spot lesions. American Journal of

Orthodontics and Dentofacial Orthopedics. 2013;143(4):S78-S84.

33. Jayarajan J, Janardhanam P, Jayakumar P. Efficacy of CPP-ACP and CPP-ACPF on enamel remineralization-An in vitro study using scanning electron microscope and DIAGNOdent®. Indian journal of dental research. 2011;22(1):77.

34. Willmot D. White lesions after orthodontic treatment: does low fluoride make a difference? Journal of orthodontics. 2004;31(3):235-242.

35. Rajab MS. Use of Single Dose 940 nm diode Laser to Relief Facial Pain. Tikrit Journal for Dental Sciences. 2022;10(1).

36. Yassaei S, Motallaei MN. The effect of the Er: YAG laser and MI paste plus on the treatment of white spot lesions. Journal of Lasers in Medical Sciences. 2020;11(1):50.

37. Al-Mamoori RMH, Al Haidar AHM. Effect of Resin Infiltration and Microabrasion on the Microhardness of the Artificial White Spot Lesions (An in Vitro Study). Journal of Baghdad College of Dentistry. 2022;34(1):44-50.

38. Sundfeld RH, Franco L, Gonçalves R, De Alexandre R, Machado L, Neto D. Accomplishing esthetics using enamel microabrasion and bleaching—A case report. Operative dentistry. 2014;39(3):223-227.

39. Gosnell ES, Patel RV, Wright JT, Thikkurissy S. Management of Esthetic Concerns. Handbook of Clinical Techniques in Pediatric Dentistry. 2021:143-157.

40. Ritter AV. Talking with patients. J Esthet Restor Dent. 2005;17:384.

41. Rahaman MN, Day DE, Bal BS, Fu Q, Jung SB, Bonewald LF, et al. Bioactive glass in tissue engineering. Acta biomaterialia. 2011;7(6):2355-2373.

42. Sauro S, Watson TF, Thompson I. Dentine desensitization induced by prophylactic and air-polishing procedures: an in vitro dentine permeability and confocal microscopy study. Journal of dentistry. 2010;38(5):411-422.

43. Burwell A, Jennings D, Greenspan DC. NovaMin and dentin hypersensitivity--in vitro evidence of efficacy. The Journal of clinical dentistry. 2010;21(3):66-71.

44. Paris S, Meyer-Lueckel H. Infiltrants inhibit progression of natural caries lesions in vitro. Journal of dental research. 2010;89(11):1276-1280.

45. Kannan A, Padmanabhan S. Comparative evaluation of Icon® resin infiltration and Clinpro™ XT varnish on colour and fluorescence changes of white spot lesions: a randomized controlled trial. Progress in orthodontics. 2019;20(1):1-8.

46. Knösel M, Eckstein A, Helms H-J. Long-term follow-up of camouflage effects following resin infiltration of post orthodontic white-spot lesions in vivo. The Angle Orthodontist. 2019;89(1):33-39.

47. Kim S, KIM EY, JEONG TS, KIM JW. The evaluation of resin infiltration for masking labial enamel white spot lesions. International journal of paediatric dentistry. 2011;21(4):241-248.

48. Wang Q, Meng Q, Meng J. Minimally invasive esthetic management of dental fluorosis: a case report. Journal of International Medical Research. 2020;48(10).