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# Prevention and Treatment of White Spot Lesion Associated With Fixed Orthodontic Treatment

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Pedodontics and Prevention in Partial Fulfillment for the Bachelor of Dental Surgery

By

**Marwa Amer Mahdi**

Supervised by:

**Lect. Meena Ousama**

**B.D.S., M.Sc (Pediatric Dentistry)**

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# Certification of the Supervisor

I certify that this project entitled" **Prevention and Treatment of White Spot Lesion Associated With Fixed Orthodontic Treatment** " was prepared by the fifth-year student **Marwa Amer Mahdi** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry .

**Lect. Meena Ousama**

**May,2022**

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# Table of Contents


| No. | Title | Page No. |
|---|---|---|
| | Table of contents | III |
| | List of figures | IV |
| | List of Abbreviations | V |
| | Aims of the study | VI |
| | Introduction | 1 |
| | Literature Review | |
| 1.1 | Prevalence of White Spot Lesion and Risk Factors | 4 |
| 1.2 | Formation and Distribution of White Spot Lesion | 5 |
| 1.3 | Prevention and Management of White Spot Lesion | 6 |
| 1.3.1 | Oral hygiene control | 7 |
| 1.3.2 | Fluoride products | 8 |
| 1.3.2.1 | Fluoridated toothpaste | 9 |
| 1.3.2.2 | Fluoridated mouthwashes | 9 |
| 1.3.2.3 | Fluoride varnishes | 10 |
| 1.4 | Strategies to enhance or boost the anticariogenic properties of fluoride | 12 |
| 1.4.1 | Use of casein phosphopeptides amorphous calcium phosphate | 13 |
| 1.4.2 | Probiotics | 15 |
| 1.4.3 | Polyols | 15 |
| 1.4.4 | Antiseptics | 15 |
| 1.4.4.1 | Chlorohexidine | 15 |
| 1.4.4.2 | Laser | 16 |
| 1.5 | After orthodontic treatment | 18 |
| 1.5.1 | Remineralization | 18 |
| 1.5.2 | Bleaching | 19 |
| 1.5.3 | Micro abrasion | 20 |
| 1.5.4 | Erosion-infiltration | 20 |
| | Conclusion | 22 |
| | Reference | 23 |

# List of Figures


| No. | Title | Page No. |
|---|---|---|
| 1 | Risk factor for developing White Spot Lesion | 5 |
| 2 | White Spot Lesion in labiogingival area | 6 |
| 3 | Oral hygiene control | 8 |
| 4 | Fluoride products | 9 |
| 5 | Chlorhexidine | 16 |
| 6 | Demineralization and remineralization | 18 |

# List of Abbreviations

| The Word | The Meaning |
|---|---|
| BAG | Bioactive Glass |
| CPP | Casein Phosphopeptides |
| CPP-ACP | Casein phosphopeptides Amorphous Calcium Phosphate |
| ICDAS | International Caries Detection And Assessment System |
| WSL | White Spot Lesion |
| APP | Amorphous Phosphopeptides |

# Aims of the study

The aims of this study were to outline the diagnostic method, risk factors, and new advances in preventive strategies of White Spot Lesion associated with fixed orthodontic treatment, and the modern methods to manage them.

# Introduction

## Introduction

The smile is an essential component of the face's attractiveness, which is important for human interactions. As a result, features of the gingival and tooth-related aspects such as size, position, form, and color influence the aesthetic self-perception of the smile ***(Nio et al., 2021).***

demineralization or White Spot Lesion (WSL) development in the enamel in association with orthodontic treatment with fixed appliances remains a well-known clinical problem for dental specialists ***(Bergstrand et al., 2011).***

Various methods how to prevent its formation are discussed in the literature, but still it is not determined which one is the most effective. WSLs can become visible around fixed appliances within one month of bracket placement, although the formation of regular caries usually takes at least 6 months ***(Oggard, . 2008)***

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White Spot Lesion (WSL) is defined as "first evidence of a caries lesion over the enamel structure that can be seen by naked eye" ***(Fejerskov et al., 2015).***

WSL has an opaque, White, chalky appearance produced by mineral lost on the enamel surface and subsurface, which is increased when drying. In contrast to non – carious White Spots, which are normally smooth and glossy, these Lesions appear rough and porous ***(Heyman and Graucer, 2013).***

Individuals with malocclusion usually have difficulty in performing proper oral hygiene because of many retention sites. In addition, bonding attachments to teeth make conventional oral hygiene more difficult, and can prolong plaque accumulation on tooth surfaces ***(Maxfiled et al., 2012;Luuchese et al., 2013).***

After the orthodontic brackets are removed and teeth cleaning is made possible, the porosity of the deeper parts of lesions is reduced. The back of fluids to a saturated state induces a change in the balance and mineral reprecipitation at deminerlization areas. As a result, the lesion's surface may become hard and glossy, the White areas gradually disappears, although it's important to know how these Lesions form and what are the risk factors. Because it is difficult to detect WSL in the initial stage to be enough for clinicians to take preventive treatment to regulate the deminilerization process before the lesions advance ***(Deveci et al., 2018).***

WSLs mainly appear on buccal surfaces of the maxillary teeth in the following order: lateral incisors, canines, premolars, and central incisors ***(Chapman et al., 2010 ;Baeshen et al., 2011).***

According to the literature the prevalence of WSLs after orthodontic treatment is about 50% and its prevention is the purpose of every orthodontist ***(Al Maaitah et al., 2011).***

Primary prevention of WSLs can be done adjacent to fixed appliances and secondary prevention (treatment) is done when the braces are removed. WSLs can be very difficult or sometimes even impossible to improve when fixed appliances are removed, and complete resolution of the Lesions can rarely be achieved, it influences aesthetics and the patients' satisfaction with their smile ***(Karlinsey et al., 2009).***

Moreover, untreated WSLs can lead to the formation of dental caries and restorative treatment. Saliva can re-mineralize WSLs to some degree, although this process is faster during the first few months, and later it becomes slower ***(Mayne ., 2011).***

Thus an early prevention of the WSLs is one of the goals of modern orthodontic treatment. Natural remineralization through saliva involving mineral gain in the surface layer of WSLs has little improvement on the aesthetics and structural properties in the deeper lesions ***(Cochrane ., 2010 And Yetkiner ., 2014).***

Therefore, it is necessary to apply remineralizing agents to repair the deeper parts of WSLs for better aesthetic results. As the use of various fluoride and casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) derivatives ***(Hen H, et al., 2013).***

Although advancements in orthodontics have resulted in improved appliance and treatment processes quality, ultimately resulting in a higher standard of patient care, the challenge of White Spot Lesion remains a common orthodontic problem ***(Deveci et al., 2018).***

# Literature Review

## 1.1. Prevalence of White Spot Lesions and Risk Factors

Clinically, WSLs might develop rapidly, appearing on the 4th week after initiating treatment in the presence of poor oral hygiene ***(Bishara et al., 2008).***

These decalcifications have been reported to be more common in patients undergoing fixed orthodontic treatment. However, their frequency has been reported to be widely variable, from 2% to 97% in different epidemiological studies, which might be explained by the techniques used to detect and characterize them, including visual inspection, photographs, fluorescent methods, and optical modalities such as diagnodent, quantitative light-induced fluorescence, and digital image fiber-optic transillumination ***(Heymann And Grauer., 2013).***

Methods using quantitative laser techniques are more sensitive, yielding a higher prevalence rate than the simple visual technique. On average, such decalcifications are found in 15.5%–40% of patients before orthodontic treatment and in 30%–70% during the treatment ***(Sangamesh And Kallury., 2011).***

Based on meta-analysis, in the 14 studies evaluated for WSLs, the incidence rate of new carious lesions that developed during orthodontic treatment was 45.8%, with a prevalence rate of 68.4% in patients under orthodontic treatment. It was concluded that the incidence and prevalence rates of WSLs are quite high and alarming in patients receiving orthodontic treatment, necessitating the attention of both patients and caregivers to effective caries prevention measures ***(Sangamesh And Kallury., 2011).***

Therefore, before undertaking orthodontic treatment, these lesions should be diagnosed and recorded by means of standardized photographic plates, taking into account magnification, exposure time, lighting, etc. WSLs before orthodontic treatment are considered a risk factor for the development of new lesions, with poor oral hygiene, excessive drinking, frequent use of fermentable carbohydrates, excess bonding, long etching time (>15 s), decayed/treated molars, and the duration of treatment being considered other risk factors ***(Sangamesh And Kallury ., 2011)*** ,Figure(1).

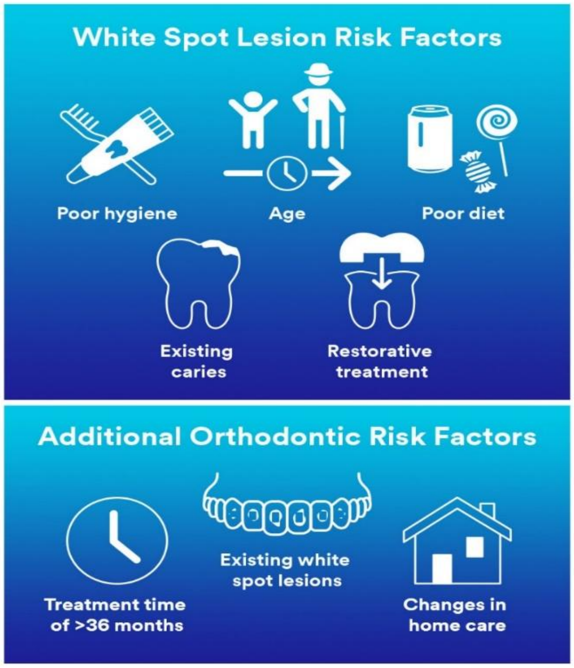
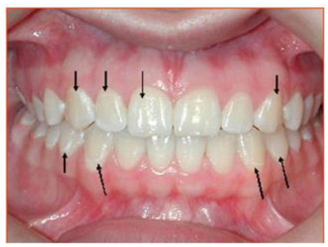



**Figure (1),** Risk factor for developing White Spot Lesion ***(Sangamesh And Kallury., 2011).***

## 1.2. Formation and Distribution of White Spot Lesions

There is a major change in the bacterial flora of the plaque in the oral cavity after orthodontic fixed appliances are introduced into the oral cavity, with higher concentrations of acidogenic bacteria in the plaque, the most important of which are Streptococcus mutans and Lactobacilli ***(Lundstrom And Krasse., 1987).***

High concentrations of bacteria lower the plaque in orthodontic patients to a greater extent compared to that in other patients, resulting in more rapid progression of caries in patients with a full set of orthodontic appliances. WSLs might appear within 1 month of bracket placement around the brackets; regular carious Lesions normally take at least 6 months to develop. WSLs commonly appear on the buccal aspects of teeth around the brackets, especially in the gingival area ***(Lundstrom And Krasse., 1987),*** Figure (2).



**Figure(2),** White Spot Lesion in labiogingival area ***(Morrier 2014)***

With the labiogingival area of lateral incisors as the most common and the maxillary posterior segments as the least common site for WSL; males are affected at a higher rate in comparison to females. A significant increase was reported in the prevalence of these lesions around the brackets bases or between the brackets/bands and in the gingival margins in the cervical areas and the middle thirds of the teeth under orthodontic wires and also with full-coverage rapid maxillary expanders ***(Morrier 2014).***

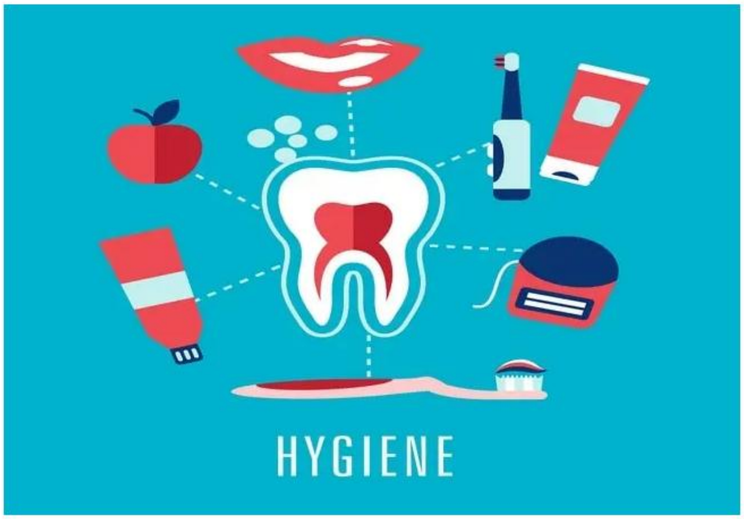
## 1.3. Prevention and Management of White Spot Lesions

WSLs should be managed using a multifactorial approach. The most important strategy is to prevent demineralization and biofilm formation, and use of methodologies for remineralization of lesions, thinning, microabrasion, erosion-infilration, adhesive composite resin restorations, and the bonded facets ***(Morrier., 2014).***

### 1.3.1. Oral hygiene control

Prevention should first begin by educating and motivating the patient for compliance with a noncariogenic diet and observation of oral hygiene. Effective oral hygiene is the bedrock of prophylactic measures in fixed orthodontic patients. 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, is strongly recommended. During the recall visits, patient motivation should be reevaluated and if deemed necessary, the tooth surfaces should receive a professional cleaning and oral hygiene and dietary instructions should be repeated. Use of a power toothbrushes or daily irrigation with water in association with manual tooth brushing might prove more effective in decreasing accumulation of plaque compared to manual toothbrushing alone ***(Ogaard et al,. 2001).***

Professional prophylactic cleaning reduces the bacterial load, increases the efficacy of brushing, and facilitates cleaning by the patient. Professional tooth cleaning two or three times a year helps maintain a healthy mouth, decreasing the risk of dental caries and the number of teeth with carious lesions, Fluoridated pastes with progressively finer particle sizes can be used to polish coronal surfaces; furthermore, elastomeric polishing cups or brushes help prevent mechanical retention of bacteria ***(Zabakova-bilbilova et al., 2014),*** figure(3).




**Figure(3),** Oral Hygiene control ***(Zabakova-bilbilova et al., 2014).***

Along with the brushing frequency, patient age, time past from appliance removal, length of treatment, type of the tooth (central or lateral incisor), and WSL surface area had also affect WSL improvement ***(Zabakova-bilbilova et al., 2014).***

## 1.3.2. Fluoride products

The favorable role of fluoride in preventing WSL has been documented with the use of the following: fluoride mouthwashes, fluoride gels, fluoride toothpastes, fluoride varnishes, fluoride in bonding agents, and fluoride in elastomers Figure(4). The fluoride ion prevents dental caries, by modifying bacterial metabolism in dental plaque through inhibition of some enzymatic processes, by inhibiting production of acids by altering the composition of bacterial flora and/or the metabolic activity of microorganisms, and by decreasing demineralization and promoting remineralization of carious lesions at early stages through a remineralization effect, especially at low concentrations ***(Marinho, 2009).***


**Figure(4),** Fluoride products ***(Marinho 2009).***

### 1.3.2.1. Fluorinated toothpastes

The fluoride concentration of toothpastes (in the form of sodium fluoride, monofluorophosphate, stannous fluoride) should be over 1000 ppm; toothpastes with higher fluoride concentrations are most effective. The use of a dentifrice with a high fluoride concentration (5000 ppm), twice daily, by patients at high risk for WSL is more effective than conventional formulations ***(Al- Mulla , et al., 2010).***

However, such a toothpaste (Duraphat) cannot be prescribed for patients under 16 years of age. This toothpaste is for brushing in the evenings only. Nonetheless, use of a fluoride toothpaste alone is not effective in preventing WSL in the majority of patients, even with good oral hygiene. Therefore, it is recommended that other fluoride sources be used ***(Bergstrand And Twetman., 2011).***

### 1.3.2.2. Fluoridated mouthwashes

Daily use of fluoridated mouthwashes containing sodium fluoride has been shown to result in a significant decrease in the development of carious lesion around and beneath bands. Antibacterial agents have been incorporated into these mouthwashes, including chlorhexidine, triclosan, or zinc to promote their cariostatic effects ***( Marinho , 2009).***

***(Benson et al., 2003 )*** carried out a systematic review and recommended the daily use of 0.05% NaF mouthwash to prevent enamel demineralization during fixed orthodontic treatment .A daily mouthwash containing NaF (0.05% or 0.2%) and/or weekly rinse containing alpha-1-fetoprotein (1.2%) have been demonstrated to decrease the incidence of enamel demineralization during fixed orthodontic treatment.

**1.3.2.3. Fluoride varnishes**

Fluoride varnishes (2–4 applications yearly) have proved effective in decreasing the incidence of caries in both deciduous and permanent dentitions ***(Marinho et al., 2013).***

Fluoride varnishes have proved a safe method of fluoride application. Advantages of fluoride varnishes over other topical fluoride regimens include protection of enamel in the absence of patient compliance and continuous fluoride release over a long period of time. The application of a fluoride varnish resulted in a 44.3% decrease in enamel demineralization in patients undergoing orthodontic treatment ***(Walsh, et al., 2010).***

It has been reported after a 3-year follow-up period that application of a fluoride varnish every 6 months proved most cost-effective technique for high- and medium-risk groups ***(azarpazhooh And Limeback ., 2008).***

Its also concluded that Durafluor and Duraphat released fluoride at a slow rate for up to 6 months, with the greatest release observed during the first 3 weeks, followed by a more gradual delivery. Therefore, they supported the recommendation of a biannual application of single-dose preparations. However, some studies have recommended an application every 90 days (every 3 months) to promote adequate protection ***(vivaldi, et al., 2006).***

The application of a fluoride varnish every 6 weeks during orthodontic treatment has been shown to effective in some other studies. Recently, an in vivo study by ***(Perrini* et al., 2016)** showed that periodic application of fluoride varnishes in patients undergoing fixed orthodontic treatment can provide some protection against WSLs, which might not be statistically significant if the patients exhibit excellent oral hygiene.

A one-time application of a fluoride varnish, just before the initiation of orthodontic treatment, did not provide any additional preventive advantage over good dental hygiene with the use of fluoride toothpastes in terms of the development of WSLs and gingivitis in patients at a low to moderate caries risk. Patients often undergo an application of fluoride varnish just before orthodontic treatment with fixed appliances. However, the efficacy of this technique is yet to be elucidated ***(kirschneck , et al., 2016).***

Considering the low efficacy of patient-applied measures, there have been attempts to use the benefits of materials that release fluoride over time, including continuous release of fluoride from the bonding system around the bracket base, which can be very advantageous. Fluoride-containing adhesives have not proved effective in decreasing demineralization, but compomers and glass-ionomer cements have been promising in this context. Glass-ionomer cements are less strong than composite resins; therefore, there are more bracket failures when they are used for orthodontic bonding procedures ***(Turner , et al., 1993;Banks , et al., 1997;Millett , et al., 2000;Vahid dastjerdi , et al., 2012).***

Ever-increasing attention has been devoted to the use of “smart” bioactive materials in the dental field, especially to remineralize dentin, with Bioactive Glass (BAG), BAG-ionomer, being incorporated into gastrointestinal to enhance bioactivity, tooth regeneration, and reconstruction capacity in some studies ***(Khoroushi And Keshani ., 2013).***

The release of fluoride from elastomeric ligatures might help decrease demineralization prevalence; however, incorporating fluoride into elastics might affect their physical properties, resulting in their faster deterioration in the oral cavity ***(Miethke , et al., 1997;Banks , et al., 2000;Mattick, et al., 2001;Benson, et al., 2013).***

A study suggested that orthodontic cements with microcapsules release bioavailable fluoride, calcium, and phosphate ions near the tooth surface, with the capacity to be recharged with fluoride and with no effect on the adhesion of the material to enamel ***(burbank , et al., 2016).***

Incorporation of microcapsules into dental materials might promote remineralization. Various intraoral fluoride slow-release devices, including copolymer membrane device, glass device containing fluoride, hydroxyapatite-Eudragit RS 100, diffusion-controlled fluoride system and slow-release tablets for intrabuccal use have been introduced in recent years, with the capacity to release small amounts of fluoride over a long period of time, possibly for up to 6 months, before being replaced ***(Garcia godoy , 1993;Marini, et al., 1999;Pessan , et al., 2008).***

### 1.4. Strategies to enhance or boost the anticariogenic properties of fluoride

The remineralization strategies used to boost fluoride increase the concentration of calcium and phosphate ions delivered to carious lesions and/or increase their concentrations in the plaque and saliva ***(Reynolds, 2009).***

### 1.4.1. Use of casein phosphopeptides amorphous calcium phosphate

Demineralization of enamel might be prevented by products containing casein phosphopeptides-amorphous calcium phosphate (CPP-ACP), it has been reported that CPP-ACP, which is derived from milk casein, was absorbed through the enamel surface and affected the demineralization-remineralization processes. Recent research has shown that this is accomplished by a part of the casein protein referred to as CPP, which carries calcium and phosphate ions "stuck" to it, in the form of APP ***(Shen, et al., 2001; Cross , et al., 2004).***

This complex of CPP-ACP delivers the bioavailable calcium and phosphate ions. It has been suggested that the anticariogenic activity of CPP-ACP relies on the incorporation of nanocomplexes into the dental plaque and on the tooth surface, thereby serving as a calcium and phosphate reservoir. CPP-ACP binds to the bacterial wall and tooth surfaces ***(Iijima , et al., 2004).***

In case of an intraoral acid attack, the calcium and phosphate ions are released, reaching a supersaturated state of ions in the saliva and then precipitating a calcium-phosphate compound on the exposed tooth surface. In addition, the breakdown of the CPP can help increase the pH (buffer) by producing ammonia; in addition, it might prevent bacterial adhesion to tooth surfaces and delay formation of biofilms. There is no Cochrane review available on the role of CPP-ACP in demineralization and remineralization. Nonetheless, several in vitro and in situ studies have shown that CPP-ACP-containing products decrease demineralization and support remineralization ***(Andersson, et al., 2007;Ellwood , et al., 2008;Kecik , et al., 2008).***

CPP-ACP might be incorporated into chewing gums, lozenges, or creams. It is marketed as a cream for application on tooth surfaces twice a day after brushing the teeth ***(Sudjalim , et al., 2006).***

Lesions developed during orthodontic treatment are good candidates for studying remineralization strategies because treating such lesions with agents containing concentrated fluoride can mineralize the surface but not the lesion body, making the arrested lesions, depending on their location, an esthetic concern over time ***(Pickett , 2011).***

It is believed that the mechanism of action of CPP-ACP paves the way for deeper penetration of ions, resulting in remineralization of the entire body of the lesion rather than only the surface layer; this improves the esthetic appearance. In such studies, the duration of intervention is relatively short because it is believed that the bulk of regression of postorthodontic WSLs occurs immediately after debonding of brackets. A study showed that application of CPP-ACP-containing varnish to bovine incisors, with or without brushing and use of a mouthwash, decreased the depth of carious lesions around orthodontic brackets ***(Jenatschke , et al., 2004;Sengun, et al., 2004).***

Some studies have shown that daily application of a remineralizing cream was more effective in reversing the severity and visual appearance of postorthodontic WSLs compared to fluoride toothpaste. Application of CPP-ACP might be more effective than the fluoride rinse for remineralization postorthodontic treatment WSLs.Therefore, the ability of the CPP-ACP to prevent the formation of orthodontic WSLs in the long term is yet to be elucidated. Clinical studies are not sufficiently strong and conclusive to end in reliable recommendations ***(Ogaard, et al., 2001; Olivi, et al., 2009; Kronenberg , et al., 2009;Karandish , et al., 2014)***

### 1.4.2. Probiotics

Probiotics are live microorganisms with health benefits when they are administered in adequate numbers. It is hypothesized that probiotic strains interfere with or inhibit other microorganisms, especially pathogens. Probiotic bacteria might enhance to the effect of fluoride in preventing dental caries ***(Fox , et al., 1997 ; Verma, 2012).***

### 1.4.3. Polyols

Polyols are sweeteners that are weakly metabolized (sorbitol) or not metabolized (xylitol) by cariogenic bacteria. Evidence supports that xylitol is noncariogenic, exhibits a dose- and frequency-dependent effect on dental plaque and mutans streptococci, and is safe. Chewing gum with xylitol (2 g of xylitol/socket) or polyols is recommended after each meal (three times daily) for 10-20 min.Sengun reported that xylitol lozenges significantly decreased the acidity of dental plaque in fixed orthodontic appliance patients. The xylitol lozenges helped neutralize the acidity of dental plaque after the consumption of sucrose in patients undergoing fixed orthodontic treatment ***(Rodrigues , et al., 2004; Liu ,2006; Esteves , et al., 2011; Ahrari , 2012; Meeran, 2013).***

### 1.4.4. Antiseptics

#### 1.4.4.1. Chlorhexidine


**Figure(5),** Chlorohexidine ***(benson , et al., 2005).***

Chlorhexidine is the most commonly used antiseptic in dentistry(Figure 5) and has proved very effective in the control and management of biofilms in gingivitis. It is available as mouthwashes, gels, or varnishes. It affects cariogenic flora and decreases mutans streptococci counts. Chlorhexidine varnishes are more effective than its gels and mouthwashes. Some studies have shown the efficacy of chlorhexidine varnishes figure(6) in decreasing the prevalence of caries during orthodontic treatment while others have not shown the efficacy of a varnish of 40% chlorhexidine ***(Benson , et al., 2005;Guzman , et al., 2010;Steiner, et al., 2010).***

### 1.4.4.2. Lasers

Laser irradiation for its acid resistance might be an invaluable adjunct to conventional acid etching at susceptible sites in patients at high caries risk, including those with rampant caries, those with disabilities unable to follow oral hygiene instructions, or those receiving orthodontic treatment with attachments on their teeth that retain plaque. Application of lasers to prevent caries dates back to 1972. Laser beams increase enamel microhardness and resistance to acid attack. The principal lasers that are used in preventive dentistry include the argon lasers, $CO_2$, Nd-YAG, and erbium YAG ***(Denis, et al., 2013;Sonesson, et al., 2016).***

Irradiation of enamel with argon laser beams decreases the amount of demineralization up to 30%–50%. Fox reported that, apart from decreasing enamel demineralization, laser beams lowered the dissolution threshold pH value. Laser beams resulted in changes in surface morphology but maintained an intact enamel surface. Several mechanisms have been suggested to explain increased resistance of enamel to caries after laser irradiation, but the exact mechanism is yet to be elucidated. The most likely mechanism appears to be through the formation of microspaces within the enamel after exposure to laser beams. These microspaces trap the released ions and serve as sites for remineralization within the enamel surface. Application of argon laser beams (488 nm) significantly decreased the mean Lesion depth compared to visible light controls, supporting the fact that irradiation with argon laser beams might prevent the development of WSLs during treatment ***(Senestraro, et al., 2013;Kim , et al., 2016).***

There are conflicting reports on the effects of lasers in preventing WSLs associated with orthodontic treatment, highlighting the need for randomized clinical trials ***(Yetkiner, et al., 2014;Khoroushi , et al., 2015).***

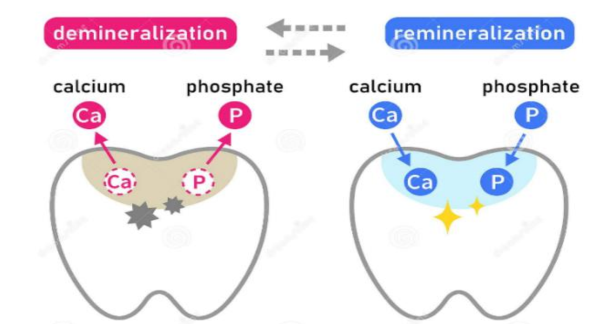
## 1.5. After the Orthodontic Treatment

When the orthodontic appliances are removed, it is common to see a regression appearance of WSLs due to natural remineralization by saliva and abrasion due to brushing in the presence of oral and food hygiene ***(Sundfeld , et al., 2007).***

This improvement depends on the severity of Lesions and occurs in the order of 6 months of the debonding process; however, it is not sufficient and these WSLs should be treated. As a result, so it is recommended a delay of 6 months before treating these lesions ***(Kim, et al., 2011).***

### 1.5.1. Remineralization

The first choice for the elimination of WSLs is remineralization which, apart from strict oral hygiene measures, involves repeated applications and the compliance of a motivated patient and might take a long time. Several professionally and home applied products are available in different forms for such a purpose: solutions, varnishes, creams, pastes, and chewing gums. These products contain fluorides and/or casein phosphopeptide-amorphous calcium phosphate, and there is evidence with varying degrees of success in the dental literature ***(Knosel, et al., 2013;Eckstein , et al., 2015)*** figure (6).




**Figure(6),**Demineralization and reminerlization ***(eckstein , et al., 2015).***

***(Denis* et al,.2013)** Advocated these measures for score of 0 and 1 of these Lesions based on the ICDAS classification. However, from the score 2, these measures were unable to remineralize the Lesions in all their depth and it was necessary to consider more invasive techniques such as erosion–infiltration, bleaching, and microabrasion.

Products with high concentrations of fluoride are not recommended for the treatment Lesions in incisors and canines because they lead to tooth discoloration. It should be considered that there is a lack of reliable scientific data to support remineralizing or camouflaging approaches to manage postorthodontic WSLs and further well-designed trials are needed ***(Tirlet , et al., 2013).***

**1.5.2. Bleaching**

The esthetic results of bleaching procedures are limited and they might give rise to tooth sensitivity and a decreased enamel microhardness. However, a study showed that bleaching incipient enamel caries with 10% carbamide peroxide could camouflage WSLs with no effect on the chemical and mechanical properties of the enamel; in addition, application of casein phosphopeptide-amorphous calcium phosphate was considered an adjunct treatment for promotion of mineral gain in the subsurface lesion ***(Sangamesh And Kallury., 2011).***

***(Khoroushi And* Keshani,.2013)**. Showed in an in vitro study that a gentle, noninvasive 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. This treatment modality should be reserved for patients with good oral hygiene to mask inactive Lesions when natural remineralization is not complete .

### 1.5.3. Microabrasion

Microabrasion consists 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. As microabrasion is relatively more invasive in nature, it was believed that delayed application was beneficial given improvements of Lesions through saliva-based remineralization and spontaneous surface abrasion subsequent to debonding. This is a useful method for the treatment of postorthodontic WSLs, but the depth of the lesion should be under 0.2 mm and it might be associated with the bleaching technique ***(Sundararaj , et al., 2015).***

### 1.5.4. Erosion-infiltration

A minimally invasive treatment modality has been introduced, in which the WSL is infiltrated with the use of a low-viscosity resin. HCl etching is used to transform the outer surface into a more permeable, and the underlying porous structure is infiltrated with the use of a triethylene glycol dimethacrylate-based resin.Infiltration of proximal carious Lesions (micropores) is initiated with a very low-viscosity resin, manufactured by dimethylglycine (icon). The procedure involves the penetration of the resin through etching with 15% hydrochloric acid for 20 s, followed by rinsing, drying, and dehydration of the enamel surface with ethanol. This resin stops the progression of caries and the other, with a refractive index close to that of sound enamel, camouflages the WSL in addition to reinforcing the compromised enamel prism structure ***(Bishara And Ostby., 2008).***

The camouflage effect of this technique has been demonstrated both in vitro and in vivo. This camouflage effect varies depending on the depth of the lesion. The treatment is more effective esthetically in the early stages when it is in the active rather than in the inactive stage. Since this is a new technique, there is insufficient clinical experience available in relation to orthodontic WSLs. Although 1-year follow-up study demonstrated that the method can create an enduring esthetic improvement of postorthodontic WSLs ***(heymann And Grauer ., 2013).***

***(Feng and Chu ,.2013).*** did not observe color changes after 2, 6, and 12 months, respectively. However, ***(Tirlet*** **et al ,.2013)** reported good clinical outcomes 19 months after the treatment of nonorthodontic WSLs such as fluorosis after trauma An in vitro study by Yetkiner evaluated the color 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.

# CONCLUSION

Orthodontic treatment causes demineralized white spot lesions, which are iatrogenic. Their occurrence is especially high in Orthodontic patients, and because they impact teeth in the cosmetic zone, they are a source of concern for both patients and clinicians. While prevention is preferred, high-risk patients may nonetheless develop these lesions, making management even more critical. While there are a variety of treatment options for those lesions, prevention is the best option and should be the first line of defense. WSLs can be avoided by practicing good dental hygiene and mechanical plaque cleaning. The availability of fluoride, even in minimal amounts, is required to prevent caries.

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