White spot lesions and its management An overview

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Abstract

Fixed orthodontic appliance disturbs oral environment, enhancing plaque formation around appliance elements and initiating process of enamel demineralization. Coupled with poor oral hygiene this can result in formation of early carious areas known as White spot lesions (WSL's). The presence of white spot lesions after removal of orthodontic appliances is a discouraging finding to a specialty whose goal is to improve facial and dental esthetics. Established methods for prevention of such lesions in day-to-day clinical practice are presented and discussed in this article.

Keywords: White spot lesion (WSL), Enamel decalcification, Demineralization, Remineralization, Orthodontics, Prevention.

Introduction

Enamel demineralization is a significant risk associated with orthodontic treatment especially when oral hygiene is poor. Prevention of demineralization during orthodontic treatment is one of the greatest challenges faced by the clinicians despite modern advances in caries prevention. Initial caries development in the form of white spot lesions on the labial surface is a serious side effect of orthodontic treatment with fixed appliance. Fixed orthodontic appliance creates stagnation areas for plaque and makes tooth cleaning difficult. Furthermore the irregular surfaces of brackets, bands, and wires limit the naturally occurring self cleansing mechanism of the oral musculature and saliva. WSL’s typically form around the bracket interface, usually near the gingival margins. WSL’s can become noticeable around the brackets within one month of bracket placement, although the formation of regular caries usually takes at least 6 months. Incipient Lesions are characterized by their opacity, mineral loss, and decrease of fluorescence radiance when compared to healthy enamel surfaces. Many incipient lesions have a white appearance due to an optical phenomenon caused by mineral loss in the surface and sub-surface that alters the refractive index and increases the scattering of light in the affected area, all resulting in greater visual enamel opacity. In addition, factors such as appliance design, improper use of cement lute, salivary flow and composition, enamel susceptibility, and, of course, dietary practices greatly influence the development of WSL’s. Other important factors in the development and progression of WSL’s include levels of calcium, phosphate, bicarbonate, fluoride in saliva, and genetic susceptibility. The best approach is to prevent WSL’s from occurring during orthodontic treatment. It has been proved that fluoride application, oral hygiene maintenance and dietary control have the greatest effect in reducing the occurrence of WSL’s. Dental enamel is in balance with its environment and saliva contains all the necessary elements for hydroxyapatite crystal growth. In this state of equilibrium, there is natural demineralization and remineralization continually taking place. An excellent example of this is maturation of tooth enamel that occurs shortly after a tooth erupts. The superficial lesions seen after orthodontic treatment will tend to re-mineralize more rapidly and completely than deeper lesions on removal of the cariogenic challenge. Re-mineralization varies considerably from subject to subject and from site to site in the mouth. Sometimes the amount of remineralization cannot totally overcome the amount of demineralization even with effective agent present. Following the removal of appliance, some regression of post orthodontic lesions is known to occur provided other aetiological factors are favourable. Remineralization also makes dental enamel with greater resistance to further dissolution. This is due to the fact that during remineralization, components are replaced with less soluble substances that have larger crystals. To prevent WSL’s, orthodontist should therefore assess each patient’s risk factors before and during treatment. Suitable caries preventive agents and therapies are fluoride products in the form of tooth pastes, gels, varnishes and mouth rinses, anti-microbials, xylitol gum, casein derivates and diet counselling. The use of microabrasion technique was also advocated for the removal of post orthodontic demineralized white spot lesions and superficial non-carious enamel defects. Some studies have reported a decrease in the display of WSL’s over time post orthodontic treatment. These un-aesthetic WSL’s do not regress completely, unless they are resolved with more aggressive treatment such as minimally invasive or even full restorative
dentistry. Despite many advances to improve the practice of orthodontics, WSL’s, or decalcifications, remain a common complication especially in patients with poor oral hygiene.

Measures to counteract white spot Lesions

**Oral Hygiene Education:**
The first line of defence against the development of incipient caries lesions has traditionally been patient education, with special emphasis on optimal oral hygiene. The patient should be suggested the correct technique of tooth brushing, use of specialized tips to get in between the braces, floss threaders, oral irrigators, and over the counter mouth rinses. The patient should also be warned that inadequate oral hygiene could result in caries, discoloured teeth, and periodontal disease. In many cases, patient education will also include an emphasis on proper diet with reduced intake of sugars. Despite these above mentioned efforts by the orthodontist and staff members, many patients are non-compliant with oral hygiene instructions. Unfortunately, most orthodontists have a limited background in behavioural basis of compliance. Thus, the patient non compliance presents a unique challenge to orthodontic practice.

**Use of fluoride mouthwash and varnishes:**
Dental professionals have employed fluoride for years to prevent caries and to re-mineralize enamel. A systematic review found a reduced level of caries in adolescents who have regular supervised rinsing with fluoride mouthwash. Preventive measures that do not require patient compliance would seem to make more sense for the typical adolescent orthodontic patient population. Fluoride varnish have proven track record in caries reduction when the application is done properly. Each application requires over 5 minutes of chair time and whether or not today’s high efficiency/high volume orthodontic practice will devote the time and resources to apply this protocol, is debatable. Fluoride varnish has by far the strong evidence base in the treatment of WSL’s. The potential of fluoride varnish has been evaluated in in-vitro and in-vivo studies. Stecksen-Blicks et al reported that although fluoride varnish did not totally prevent WSL formation, the incidence was significantly reduced.

**Sealants and Adhesives:**
In general, the duration of orthodontic treatment makes the patient vulnerable to increased WSL risk over a period of time. As a result, continuous fluoride release from the bonding system around the bracket base would be extremely beneficial. Glass ionomer cements (GICs) were used as orthodontic bonding adhesives to take advantage of their chemical bonding to tooth structure and sustained fluoride release following bonding. In an attempt to increase the bond strengths of GICs, resin particles were added to create resin modified GIC (RMGI) bonding systems. These adhesives release fluoride like conventional GICs but also have higher bond strengths.

**Fluoride Elastomers:**
Several manufactures are marketing elastic ligatures and power chains containing fluoride. Many investigations also suggest that fluoride-releasing elastomeric modules were effective in reducing plaque accumulation and enamel decalcification around the brackets. Fluoride containing elastomeric ligature ties released significant amounts of fluoride; this was characterized by an initial burst of fluoride during the first 2 days and was followed by a logarithmic decrease over the remainder of the 6 months test period. In the presence of fluoridated toothpaste and mouth rinse the fluoride release is also significantly more. Thus, fluoridated elastomers may imbibe fluoride from their environment.

**Low fermentable sweeteners:**
It has been suggested that xylitol may affect the process of enamel demineralization and remineralization directly. Studies evaluated the influence of a xylitol lozenge on the dental plaque profile of patients with fixed orthodontic appliances. They found that xylitol lozenges can reduce the acidogenicity of dental plaque. These sugar free gums are to be recommended after the removal of fixed orthodontic appliances, although as yet we have no quantitative information to indicate a clinically significant beneficial effect over natural remineralization.

**Argon laser irradiation:**
An interesting application of argon lasers in orthodontics involves its ability to alter enamel, rendering it less susceptible to demineralization. It was found that the use of argon lasers increase enamel demineralization resistance and might prevent the occurrence of a large percentage of WSL’s during the course of treatment.

**Microabrasion:**
Microabrasion has been widely used for the removal of superficial non-carious enamel defects. Recently, this technique has also been advocated for the removal of
post-orthodontic demineralized WSL’s. Studies have shown that microabrasion is an effective treatment approach for the cosmetic improvement of long-standing demineralized enamel lesions.25

Recent advances in management of WSL:

Most of the recent products introduced are water based, sugar free dental topical creams containing RecaldentTM. CPP-ACP (Caesin Phophopeptide–Amorphous Calcium Phosphate)26 products are used for the treatment of mild to moderate WSL’s. RecaldentTM is derived from the milk protein, casein. For many years it has been known that milk and its derivatives have a tooth protective effect. Recently, research has shown that this activity is due to a part of the casein protein called Casein Phosphopeptide (or CPP), which carries calcium and phosphate ions ‘stuck’ to it, in the form of Amorphous Calcium Phosphate (or ACP).25,26 This complex of CPP-ACP (RecaldentTM) is an ideal delivery system for bio-available calcium and phosphate ions. Some products like GC Tooth Mousse27 incorporate RecaldentTM which are helpful in protecting the oral environment in a wide range of situations where mineral imbalance may arise.

CLINICAL STATUS QUO:

In terms of the clinical status quo for the prevention of WSL’s during orthodontic treatment, a recent survey by the Journal of Clinical Orthodontics does provide information about the usage of some of the preventive measures outlined. Despite the fact that more than half of the orthodontic patients develop WSL’s, only 9.3% of orthodontists deliver fluoride varnish to the patients and more stress is laid on oral hygiene education.

CONCLUSION:

Brackets, bands, arch wires, ligatures, and other orthodontic devices increase the retention of plaque and food debris on tooth surfaces that encourages the formation of WSL’s. It is therefore of great importance to evaluate the oral hygiene status of patients during the course of orthodontic treatment. Oral hygiene education, diet check and application of anti-caries products should be strictly followed in clinical practice to reduce the incidence of WSL’s and see an increase in the smile quality quotient.

REFERENCES:


