



White Spot Lesion, the Silent Factor Killing Your Smile: An Overview

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Authors' contributions

This work was carried out in collaboration between both authors. Authors RI and MKA designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors RI and MKA managed the literature searches, analyses of the study performed. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: The aim of this paper was to present an overview of white spot lesions adjacent to fixed orthodontic appliances, which destroys the enamel beauty and how to prevent and manage of this problem.

Materials and Methods: This study was to search in six electronic databases where some keyword combinations were utilized to systematically search for those literatures until January 2016.

Results: In view of the inclusion and exclusion criteria, of these, we identified 29 articles including original articles as well as literature reviews.

Discussion: white spot lesion is very common problem associated with orthodontic treatment, various preventive and treatment options are available to prevent this problem.

Conclusion: Management of white spot lesions starts with a good oral hygiene instruction and should be connected with utilization of fluoride agents, fluoride containing mouth rinse, fluoride toothpaste, Fluoride varnish, bonding materials, CPP-ACP (Casein Phosphopeptide - Amorphous Calcium Phosphate), tooth whitening and microabrasion.

Keywords: White spot lesion; caries; enamel surface; fixed orthodontic appliance; fluoride.

1. INTRODUCTION

The formation of incipient caries, which is mostly known as white spot lesion is a non-aesthetic common result of orthodontic discussion with fixed appliances [1]. White spot lesions are defined as subsurface enamel porosities from carious demineralization with a milky white opacity, when located on smooth surfaces [2]. Lack of compliance in maintaining adequate oral hygiene can predispose orthodontic patients to white spot lesions [3].

White spot lesions around brackets are an inconvenience in patients having fixed orthodontic treatment, particularly those with poor oral cleanliness [4]. White spot lesions create in relationship with brackets, bands, arch wires, ligatures, and other orthodontic devices that confound customary oral cleanliness measures, prompting plaque accumulation [5]. In the attendance of fermentable starches, demineralization of the enamel around the bracket can happen in as meagre as 4 weeks [2,5-8]. These lesions are usually seen on the buccal surfaces of teeth around the brackets, particularly in the gingival area [6]. The frequency of white spot lesions taking after orthodontic treatment fluctuates to a great extent from 4.9% to 85% of tooth surfaces [9]. An expansion in white spot lesions in more than half of patients with fixed orthodontic treatment has been reported [9]. Some white spot lesions might remineralize and return either to typical or if nothing else to an outwardly worthy appearance. In any case, white spot lesions might likewise endure, bringing about an aesthetically unacceptable result. In extreme cases, restorative treatment might be needed [10].

The aim of modern dentistry is centered around a prophylactic methodology, rather than intrusive recovery, of carious deformities. Fluoride is the most critical operators averting demineralization, and in addition against the advancement and movement of carious lesions [11,12]. To avert decalcification and arrangement of white spot lesions, a great oral-cleanliness regimen must be actualized, incorporating legitimate tooth brushing with a fluoridated dentifrice [13]. Numerous techniques can diminish or anticipate white spot lesions: enhancing oral cleanliness, changing eating regimen (low sugar), and treating with topical fluoride. It was demonstrated a few years prior that oral cleanliness and topical

fluoride regimens amid treatment can lessen the pervasiveness of post orthodontic demineralized white spot lesion [4].

2. MATERIALS AND METHODS

An electronic search strategy was conducted in six electronic databases [Table 1] where some keyword combinations [Table 2] were utilized to systematically search for those literatures until (counting) January 2016.

Here, the principle concern was to discover the etiology and prevention of white spot lesion in dentistry. Data were completely gathered for a purposive study. The inclusion criteria were identified as the papers utilizing white spot lesion as a part of the orthodontic sector. Then again, the papers utilizing white spot lesion for other reason, which was not identified with orthodontic unquestionably, were rejected from the study. In exclusion criteria, it additionally included that those studies not done in human and the publications not in English.

After this electronic database searching, the aggregate sum of paper was established and from that, we chose various papers in view of inclusion and exclusion criteria.

Table 1. Electronic databases searched

Google scholar
PubMed
MEDLINE
Science Direct
Web of Science
Cochrane

Table 2. Keywords combination with which systematic literature search was conducted

WSLs
WSLs + fluoride
WSLs + fixed appliance
WSLs + orthodontics
WSLs + caries
WSLs + enamel surface

3. RESULTS

The studies that pursuit in the diverse databases including their selection procedure have been specified in Fig. 1. From aggregate 8330 hits, copies were evacuated and 307 studies found in

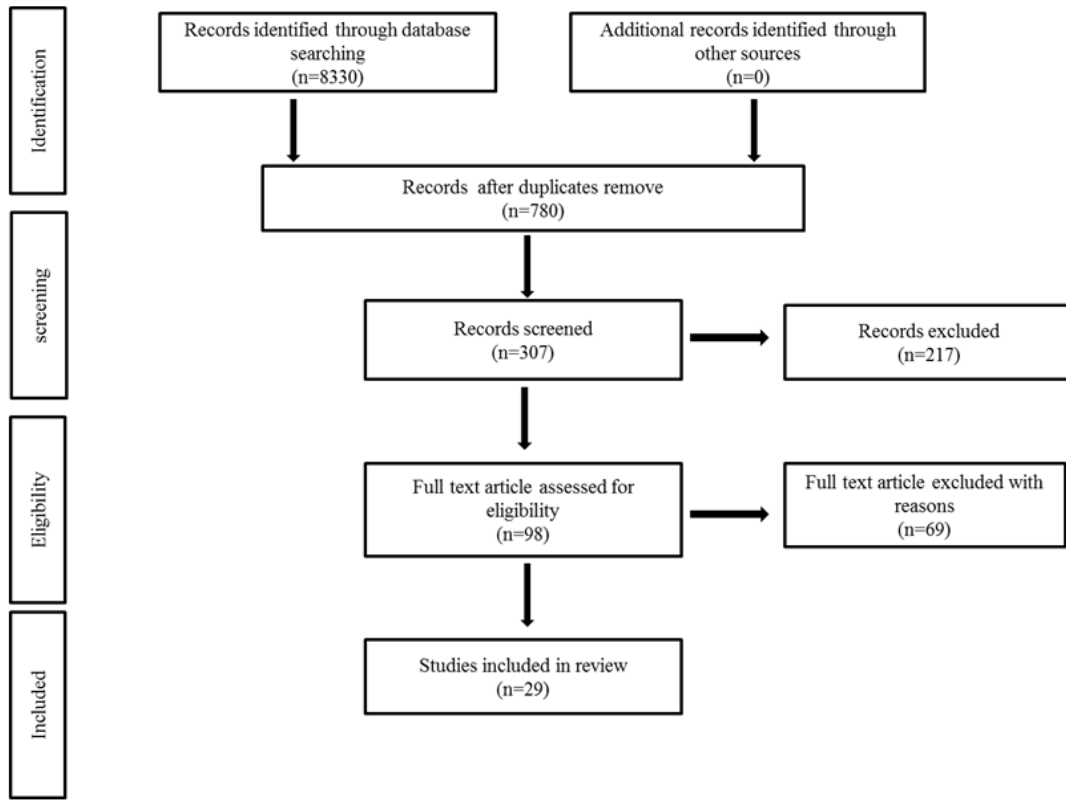


Fig. 1. Flow chart showing systematic literature search

the wake of screening. After considering the inclusion and exclusion criteria, 29 articles were identified which included original articles as well as literature reviews.

4. DISCUSSION

4.1 Prevalence and Incidence

White spot lesion growth is a very less time consuming procedure. Generally, orthodontic patients have essentially more white spot lesions than non-orthodontic patients, and these white spot lesions may introduce aesthetic issues years after treatment [13]. One study found that the predominance of no less than one white spot lesion in patients who experienced treatment with fixed orthodontic appliances was 49.6%; where its may be 24% in an untreated control group [14]. Steady with past prevalence [15] and incidence [14] reports, for the right and left sides there was no distinction in white spot lesion incidence. The facial surfaces of the lateral incisors and canines were the most seriously influenced by white spot lesions, trailed by the premolars and central incisors [1]. Like the

prevalence study, the maxillary lateral incisor is most of the time influenced by white spot lesions followed by the maxillary canine, premolar, and central incisor [15].

4.2 Formation

Studies have demonstrated that orthodontic fixed appliances impel a quick increment in the volumn of dental plaque and nonorthodontic patients have higher pH than that dental plaque [16,17]. Hence, the plaque-retentive properties of the fixed appliance incline the patient to an expanded cariogenic hazard. Moreover, there is a quick move in the piece of the bacterial flora of the plaque taking after the presentation of orthodontic appliances. More particularly, the levels of acidogenic bacteria, for example, *S. mutans*, turn out to be fundamentally raised in orthodontic patients [13]. Whether these bacteria have a sufficient supply of fermentable carbohydrates, acid by products will be created, bringing down the pH of the plaque. As the pH drops underneath the limit for remineralization, carious decalcification happens. The main clinical confirmation of this demineralization is

noticed as a white spot lesion. Like this lesions have been clinically incited inside a range of 4 weeks, which is ordinarily inside the era between one orthodontic appointment and the following [18]. This is an important finding and is essential for both the patient and the clinician to figure it out.

Particularly, cariogenic environment adjoining orthodontic appliances, these lesions can quickly advance. In the event that left untreated, they may create carious cavitations that will require a proper restoration. In this way, the diagnosis, prevention, and treatment of white spot lesions is urgent to avert tooth decay and also minimize tooth staining that could compromise the style of the smile [13].

4.3 Prevention

4.3.1 Oral hygiene instruction

The most essential prophylactic measure to avert the incidence of white spot lesions in orthodontic patients is implementing a decent oral hygiene regimen [19]. It has been indicated that there is a noteworthy relationship between poor consistence with home consideration preventive techniques and the development of white spot lesions [10].

Two times a day tooth brushing is suggested by numerous clinicians as a vital part of a day by day plaque control program for every single orthodontic patient. Numerous manual and electric toothbrushes are obtainable, with conflicting reports of the viability of the two types of brushes. Past studies researching the relative viability of manual versus electric toothbrushes in orthodontic patients have indicated ambiguous results [20]. In recent time, it has been indicated that patients who have poor oral cleanliness may accomplish better results with the usage of electric toothbrushes, since plaque removal may be more effectively performed with the active heads [21]. Usage of electric toothbrushes in combination with manual tooth brushing may be a more effective technique in decreasing plaque accumulation than manual tooth brushing alone [22].

4.3.2 Fluoride mouth rinses

For reducing white spot lesions formation beneath bands, daily use of fluoridated mouth rinses recommended by orthodontists which is containing 0.05% sodium fluoride. While the

correct utilization of these products gives the patient improved caries protection, patient understanding is required and such collaboration can be hard to get in a few patients [19]. Geiger and coworkers demonstrated that fewer than 15% of orthodontic patients rinsed daily as educated [23]. The conclusion came to is that orthodontic patients who don't agree to appropriate oral hygiene will most likely not utilize fluoride washes all the time [13].

4.3.3 Fluoride toothpaste

The orthodontist is commonly recommended the regular use of fluoride toothpaste to prevent white spot lesion development around orthodontic brackets. As orthodontic patients are at high risk of caries, a proper level of fluoride ions is required to give an anticaries advantage by raising enamel remineralization. In this way for orthodontic patients fluoride concentration beneath 0.1% in dentifrices is not prescribed [19]. Higher concentrated fluoride toothpaste (1500-5000 ppm) has been shown to have greater ability to prevent demineralization and promote remineralization [24].

4.3.4 Fluoride varnish

For the prevention of white spot lesion sodium fluoride is the agents that is mostly used, toothpaste is commonly used and also in fluoride varnish. For weakly motivated patients fluoride varnish should be used. The use of a fluoride varnish gives a protective coating over the tooth surface which reduces enamel solubility [25]. These varnishes were produced to adhere to the enamel surface for long period and slowly release fluoride on the enamel surface. Usage of fluoride varnishes has proven to be a possible and protected technique of fluoride application. It has been reported that 44.3% reduction in enamel demineralization in orthodontic patients after application of fluoride varnish [19].

4.3.5 Fluoride in bonding agents

Generally, there is high risk of caries formation due to the longer duration of orthodontic treatment. Thus continuous fluoride release would be highly beneficial around the bracket base [19]. Glass ionomer cements (GICs) were at first initiated as orthodontic bonding adhesives with exploit some of their attractive attributes, to be specific, their capacity to chemically bond to tooth structure, in addition to their continuous fluoride release following bonding. In addition to

increase the strengths of GICs bond, resin particle were added and these resin modified GIC (RMGIC) bonding systems release fluoride like conventional GIC and have higher bond strength [26,27]. In future, it has been suggested that RMGICs should play a greater role in orthodontic brackets bonding.

4.3.6 Use of casein phosphopeptides amorphous calcium phosphate

Enamel demineralization under white spot lesions might be prevented by the application of products containing Casein Phosphopeptides Amorphous Calcium Phosphate (CPP-ACP). In the 1980s, Reynolds reported that casein phosphopeptide amorphous calcium phosphate, which is an item got from milk casein, was capable of absorbing through the enamel surface and could affect the carious procedure [28]. CPP-ACP is a conveying framework that permits unreservedly accessible calcium and phosphate particles to join to enamel and change into calcium phosphate crystals. The free calcium and phosphate particles move out of the CPP-ACP and into the enamel rods and freestyle as apatite crystals [29]. Various diverse media have been created to convey the CPP-ACP, including a water-based mousse, a topical cream, biting gum, mouth rinses, and without sugar lozenges. Casein phosphopeptide amorphous calcium phosphate materials will possibly improve remineralization.

4.4 Treatment

Generally, treatment of white spot lesions should start with the conservative treatment; if such approaches do not resolve the issue to the clinician's satisfaction, more aggressive treatment modalities can be followed if the patient is interested. Many clinician preferred application of topical fluoride to the white spot lesion as their first step in treatment. Theoretically, application of high concentrated fluoride to white spot lesion may seem to be the most helpful; in fact it might have some unpleasant esthetic results. After completed orthodontic treatment, application of high concentrated fluoride may effect immediately remineralize the most superficial layer of enamel but deeper enamel crystals remain relatively unaffected. Consequently, in case white spot lesions are seen must need immediately following orthodontic treatment. It is prudent to first take into consideration that slower calcium and fluoride ion penetration of the white spot lesion through the application of lower

concentrations of fluorides or from saliva and this method may finally generate esthetically more pleasant results.

If fluoride does not improve the esthetic concerns of the patient and clinician, tooth whitening may be considered as next step. The aim of this technique is to camouflage mild and moderate fluorosis or white spot lesions by whitening the surrounding enamel surfaces. If this technique is unsuccessful, another way to use of microabrasion on the enamel surface to remove localized white spot lesions. The last option to improve the esthetic of the patient, composite restoration or porcelain veneers can be placed. The later treatment may need the removal of affected teeth and is usually more costly. However, it would be most effective in addressing the esthetic considerations of the patient in terribly severe conditions [13].

In spite of the way that all these various options are available, regardless it should be accentuated that avoidance of these lesions is the most desirable result esthetically furthermore the minimum costly for the patient.

5. CONCLUSION

Management of white spot lesions starts with a good oral hygiene instruction and should be connected with utilization of fluoride agents, fluoride containing mouth rinse, fluoride toothpaste, Fluoride varnish, bonding materials, CPP-ACP, tooth whitening and microabrasion. As demonstrated, patient's behaviour before high risk is very important though orthodontist should supervise and also choose better option for each patient.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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