White spot lesions in orthodontics: prevention and treatment. A descriptive review

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White spot lesions (WSL) are demineralizations of the enamel found on the tooth surfaces. WSL are considered incipient non-cavitated caries caused by bacterial plaque activity. Subjects with malocclusion such as dental crowding and fixed orthodontic appliances have a greater number of retention sites and consequently difficulty in cleaning and greater predisposition to caries. In fact, WSL are a frequent side effect of orthodontic fixed treatments. The prevention and resolution of this problem is the goal of any orthodontist because untreated WSL can lead to the formation of deeper dental caries and restorative treatment with consequent compromise of patient satisfaction with the aesthetic result obtained at the end of the orthodontic treatment. This review is intended not only for orthodontists but also for general and pediatric dentists who want to learn how to correctly prevent, and treat this unsightly problem. On the market there are many products sold to achieve this goal, some of them can be managed independently by the patient at home, others require the intervention of the dentist. The purpose of this literature review is to understand how these substances work, to identify with which of the currently most widespread the best results have been obtained and then to provide useful information to guide the clinician in choosing the most suitable one for the patient.

White spot lesions (WSL) are demineralizations of the enamel found on tooth surfaces (1). The optical properties of the enamel are linked to its chemical composition: a lower mineralization give to the enamel a lower capacity of refraction of light and a more chalky appearance (2). WSL appears as white or brown spots with well-defined margins and can be the consequence of different problems that act locally and systemically on the quality of the enamel. This review is intended not only for orthodontists but also for general and pediatric dentists who want to learn how to correctly prevent and treat this unsightly problem. Currently on the market there are many products sold to achieve this goal.

The aim of this review is to talk about WSL which recognize fixed orthodontic treatment as the main

Keywords: white spot lesions, fluoride, casein phosphopeptide amorphous calcium phosphate complex, casein phosphopeptide-amorphous calcium fluoride phosphate

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cause of their onset, in fact they are a frequent side effect in orthodontic patients, to understand how the treatment options work, how to apply these products correctly, compare them and understand which ones have gotten the best results.

Etiology

In accordance with the American Dental Association Caries Classification System (ADA CCS), WSL are considered incipient non-cavitated caries caused by bacterial plaque activity (3). Caries are currently one of the most common diseases in industrialized countries (4). This pathology has a multifactorial etiology and recognizes the main causes of its onset in diet, bacterial flora and host susceptibility (5). The susceptibility of the host plays a fundamental role and recognizes systemic and local factors: the main systemic factors include the quality and quantity of salivary flow and the resistance to acid dissolution of the enamel, whereas the most important local factors are dental malposition and the presence of fixed appliances (6). Indeed subjects with malocclusion such as dental crowding have a greater number of retention sites and consequently difficulty in cleaning and greater predisposition to caries (7). Furthermore fixed orthodontic appliances represent an important risk factor for WSL for several reasons (Fig 1) (8):

- brackets, with their irregular structure, create a greater number of plaque retention points on the smooth surfaces of the tooth which are normally less affected by caries;
- hinder the self-cleaning action of saliva, cheeks, lips and tongue;
- making normal oral hygiene maneuvers more difficult.

In addition it has been shown that the main bacteria responsible for caries such as Streptococcus mutans and Lactobacilli are present in greater quantities in the bacterial flora of orthodontic patients (9).

Pathogenesis

Demineralization and remineralization occur constantly on the tooth surface. Under ideal conditions these two processes are perfectly balanced with each other (10). In acidic environment, the hydroxyapatite that forms the enamel begins to dissolve, this demineralization process stops and reverses when the PH returns above 5.5. In fact, in ideal PH conditions, saliva can carry out its remineralizing action. In patients undergoing fixed orthodontic treatment, the shift towards an environment richer in cariogenic and acidogenic bacteria, such as Streptococcus mutans and Lactobacilli, favours the imbalance of this process towards demineralization (11). There can be different levels of enamel impairment, starting with demineralization, through non-cavitated caries to cavitated caries. WSL is considered the first visible sign of early stage caries: its opaque appearance is due to the loss of the surface minerals of the enamel that are responsible for its translucency and can be evidenced by the drying of the tooth (12).

It has been well demonstrated that saliva is capable to remineralize the most superficial lesions (13).

Fig. 1. *The consequences of orthodontic treatment.*

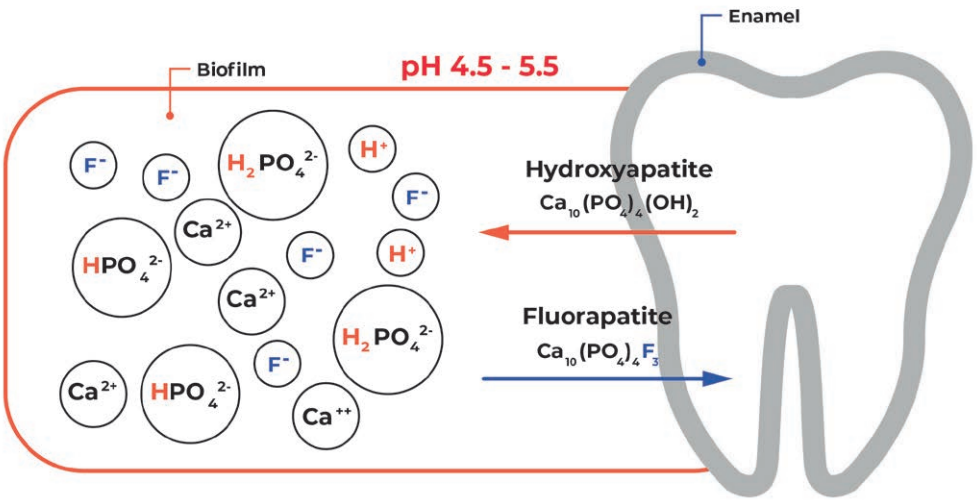

Fig. 2. *Ion exchange in the remineralization phase: when fluorine ions (F-) are present in the salivary biofilm, and PH is between 4.5 and 5.5, dissolved hydroxyapatite crystals are replaced by more resistant fluorapatite crystals during the remineralization phase.*

This process occurs thanks to the calcium, phosphate and fluoride ions dissolved in saliva and present in different concentrations depending on the changes in salivary PH and it is faster in the first months after removing the fixed appliance and slower over time. In fact it is common to think that the less deep lesions can resolve once fixed orthodontic therapy is finished and oral hygiene is restored (7, 14, 15). When fluorine ions are present in the salivary biofilm, and PH is between 4.5 and 5.5, dissolved hydroxyapatite crystals are replaced by more resistant fluorapatite crystals during the remineralization phase (Fig. 2). However natural remineralization through saliva has little improvement on the aesthetics and structural properties in the deeper lesions (2).

Epidemiology

It has been reported that this side effect occurs from 2% to 95% (16) of patients with multibracket orthodontic treatment (2, 17-21). The wide variability of the frequency found is justified in the different ways used to make the diagnosis (22): the highest prevalence was achieved in studies using more sensitive diagnostic methods than simple visual inspection such as those using autofluorescence emitted by teeth exposed to high intensity blue light (quantitative light-induced fluorescence "QLF") or the Diagnodent, a device that uses the fluorescence emitted by laser-scanned teeth to assess their degree of demineralization (5, 22). A worrying data emerged from a 2015 meta-analysis (14): the incidence of WSL in orthodontic patients is 45.8%, while the prevalence is 68.4%.

The area most affected by WSL is the labiogingival surface of the maxillary anterior teeth, while the posterior segments are less affected (12): in the upper arch incidence is higher for the lateral incisor (34%), similar for canines (31%) and premolars (28%) and lower for the central incisors (17%) (1, 8). No white spots were found on the lingual surfaces of mandibular canines and incisors after prolonged use of a canine-to-canine bonded retainer. These findings suggest a relationship between resistance to white spot formation and the rate of salivary flow (12).

Prevention

The prevention and resolution of this unsightly problem is the goal of any orthodontist, because untreated WSL can lead to the formation of deeper dental caries and restorative treatment with consequent compromise of patient satisfaction with the aesthetic result obtained at the end of the orthodontic treatment.

Therefore it becomes necessary to apply an early prevention of WSL using rinses with chlorhexidine with theirs bacteriostatic and bactericidal properties (4) and particular brushing techniques as indicated by the dentist, but most patients do not observe the list of advice received and for this reason run the risk of developing white spots (1).

Over time it has become clear that remineralizing agents need to be applied to prevent and repair deeper WSL and to protect the aesthetics of the teeth. These remineralizing substances include topical applications of fluoride in various formulations such as fluoride toothpastes and fluoride varnish and the more recently introduced casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) and casein phosphopeptide-amorphous calcium fluoride phosphate (CPP-ACFP) (17, 23).

CPP-ACP e CPP-ACFP are material derived from milk proteins and have the ability to prevent the demineralization of the enamel and favor its remineralization by maintaining the saturation condition of calcium, fluoride and phosphate ions on the tooth surface (24).

Because WSL is a form of demineralization, remineralization is the most conservative method to be tried primarily (2).

A minimally invasive technique known as Infiltration has recently been introduced to improve the aesthetic appearance of the WSL. This technique consists precisely in infiltrating the microporosities of the decalcified enamel with low viscosity resin (2, 25). Therefore, WSL can be treated with remineralizing agents or resin infiltrant.

The aim of this review is to identify with which of the currently most widespread substances the best results were obtained.

MATERIAL AND METHODS

This review started in the year 2020 using a single database: Pubmed. The research was conducted using the following keywords: white spot, enamel demineralization, enamel remineralization, orthodontics, fixed appliances, fluoride toothpastes, fluoride varnish, casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), casein phosphopeptide-amorphous calcium fluoride phosphate (CPP-ACFP), resin infiltration. Articles published in the last 10 years (from 2010 to 2020) were mainly taken into consideration. The selection of the most relevant articles was carried out first by reading the title, then the abstract and only at the end the full text. Articles that evaluated removable orthodontic appliances, fixed orthodontic appliances without brackets, or fixed orthodontic appliances with esthetic brackets (plastic or ceramic), were excluded. Studies conducted on human teeth have been taken into more consideration than those performed on animal teeth.

RESULTS

In recent years, various aids for the prevention and treatment of WSL have been proposed. Currently these products are on the market in different formulations, some of these can be taken at home by the patient, others can be managed exclusively by the dentist. The following are the most used and known products of recent years.

The most commonly used substances for the management of WSL have always been those based on fluoride. Fluoride is naturally present in different concentrations in most of the foods we eat and in the drinking water we use every day. Normally the daily fluoride requirement ranges from 1.5 to 4 mg. Fluoridated water is the first form of caries prevention aimed at the whole community. It was observed that in industrialized countries, where water enriched with the right amount of fluorine (1ppm) (26) was distributed, the inequalities in the distribution of carious disease among children aged from 5 to 12 of different social classes were reduced (27). But, when the intake of fluoride goes beyond the recommended doses, as occurs for example in areas where drinking water is very rich in fluoride, there could be a risk of developing fluorosis (28). This problem can also occur due to the excessive and involuntary ingestion of fluoride toothpaste during home oral hygiene manoeuvres. Careful supervision of the amount of fluorinated toothpaste given to the child in the first years of life is therefore necessary: the amount of toothpaste should not exceed the size of a pea to minimize this risk (29, 30). Fluorosis occurs when enamel has an excessive fluoride content that causes

white / yellow to gray stains to appear on the teeth (28, 31) (Fig. 3).

DISCUSSION

Over the years, different ways have been proposed to integrate fluoride intake for preventive purposes (32): fluoridated water, fluoridated milk, salt, tablets, drops, toothpastes, gels, paints etc. Each with different concentrations, frequencies of use and posology. To date, the preventive effect of fluoride, obtained through the local route of administration (toothpastes, gels, varnishes) after tooth eruption is considered more effective than that obtained through oral administration (33).

Several studies (30, 34, 35) have demonstrated the ability of topical fluoride applications to counteract the initial demineralization of the enamel. However, it has been understood that high concentrations of fluorine can paradoxically cause hypermineralization of the enamel surface and avoid the penetration of minerals into the deeper layers. For this reason it has been shown that it is better to use substances with a lower and appropriate fluorine concentration (36).

A study published in 2014 by Yetkiner et al. (2) analyzed the effects of the regular use of mouthwashes with sodium and amine fluoride and concluded that the best results are obtained with rinses with 250 ppm of fluoride. Five years earlier, however, Chin et al. (37) in a study on bovine enamel analyzed how the topical use for 28 days of substances with the same concentration of fluoride was not able to repair lesions of 95±32 μm deep and restore the enamel to its original appearance. The constant use of fluoride increases the resistance of the enamel to attack by organic acids and consequently reduces the appearance of decalcifications around the brackets in patients with fixed appliances (24).

Fluoride mouthwash

Mouthwash is now a widespread and accessible device, so much so that its use has become part of the normal hygiene procedures of many people. On the market it is possible to find them with various excipients and different concentrations of chlorhexidine, triclosan and zinc with anti-inflammatory action and cariostatic effect (22). It has been shown that daily use of mouthwashes based on sodium fluoride (from 0.05% to 0.5%), and/or weekly use of acidulated phosphate fluoride (1.2%) (14) are really effective in reducing the incidence of caries in patients with fixed orthodontic appliances (22).

According to some studies, the use of fluorinated mouthwashes can hinder the adhesion mechanisms and reduce the shear bond strength (24): Smith and Gwinnet found that the use of fluoride can make phosphoric acid etching procedures less effective and prevent the formation of resin tags, thereby compromising the adhesive strength of commonly used bonding materials. This theory was supported by the studies by Tabrizi et al. (38) but not by Kecik et al. (39–41) who instead observed an improvement in the shear bond strength, probably following studies performed with different concentrations of fluoride (24).

Fig. 3. *Fluorosis: different degree of severity in teeth affected by fluorosis.*

Fluoride varnish

The varnishes have the advantage of not requiring the patient's collaboration, because once applied they have the ability to remain adherent to the surface of the teeth for a long time despite the humid environment of the oral cavity (38, 42). The application of fluorine varnishes on the tooth surface creates a reserve capable of slowly releasing fluorine ions and transforming the hydroxyapatite crystals into more resistant fluorine-hydroxyapatite crystals (17). Stafford et al. (43) and Du et al. (24) respectively conducted research on the effectiveness of fluoride varnish in orthodontic patients and both came to the conclusion that these products, if properly applied, are able to reduce white spots within the first six months of removing fixed appliances (43), and can be used effectively for their prevention (1, 44, 45). Instead Majithia et al. (46) in 2016 conducted a comparative study on the effectiveness of different fluorine varnishes present at that time on the market such as MI Varnish ™ (5% sodium fluoride varnish with Recaldent™ (CPP-ACP) Technology, GC Corporation, Tokyo, Japan), Premier® Enamel Pro® Varnish (5% sodium fluoride varnish with ACP Formula, Premier Dental Products Co., Canada) and Flor-Opal® Varnish White (5% sodium fluoride varnish, Ultradent Products, Inc., USA) and concluded that the best results on artificially reproduced demineralizations were obtained with MI Varnish from GC (1, 46).

Fluoride tablets

An application of fluoride is the use of oral hygiene tablets. These aids dissolve quickly in saliva making fluoride available in shorter times and at higher concentrations than the most popular fluoride toothpastes (26). In 2011 Eggerath et al. (47) analyzed the effects of tablets with 1450ppm and 4350ppm of fluoride (Denttabs®) on artificially demineralized impacted third molars and concluded that tablets with an higher fluoride concentration have a greater remineralizing effect. Bensal et al. (48) have shown that using of fluoride tablets, such as homeopathic *Calcarea fluorica* (calc-f), with a dosage of 4 tablets twice a day is effective in improving the microhardness of the enamel in artificially induced carious lesions (1).

Fluoridated chewing sticks (Miswaks)

Miswak is a natural alternative to the traditional toothbrush, known since ancient times and currently still very popular in Arab culture (49). It is obtained from the twigs of Salvadora Persica, an evergreen tree widespread in the Indian subcontinent. The World Health Organization (50) has promoted its use for oral hygiene and for this reason it can be found on the market in the form of fragrant and tasty sticks. Chewing the miswak on the top and removing the outer part creates a structure similar to the bristles of a toothbrush, which can be rubbed on the teeth and gums or used as a toothpick. When these natural bristles start to change color, it is recommended to cut the part used and repeat the procedure (Fig. 4). Recent studies (51-53) have shown that these sticks improve tooth health not only for the mechanical removal of plaque but also for the properties of the substances they release, including fluoride (49). Beashen et al. (54), in a randomized, double-blinde, longitudinal study lasting six week, demonstrated remineralizing effects achieved using miswaks with 0,5% sodium fluoride five times a day on orthodontic patients who had at least 4 WSLs (1).

Fluoridated milk

Milk plays an important role in children's diets.

Fig. 4. *Guide on use of Miswak: bite gently or cut about 2-2.5 cm of bark to reveal the inner bristles; chew the central fibres with the posterior teeth until they become soft and frayed and form bristles; brush your teeth gently by making a circular movement; when the bristles change color it is recommended to cut them and repeat the procedure.*

Fluoridated milk is considered an alternative and relatively inexpensive method of supplementing fluoride intake in the community (26, 55). Larsson et al. (56) in a randomized controlled study on 64 adolescents with fixed orthodontic appliances demonstrated the remineralizing effect obtained by taking 200 ml of milk with 5ppm of fluoride every day for 12 weeks. Daily intake of milk enriched with fluoride can help to maintain the integrity of the enamel and counteract the formation of WSL.

Fluoride toothpaste

There are many fluoride releasing products on the market, however, fluoride toothpastes are certainly the most effective way to prevent white spots as they are currently the most common in people's oral hygiene habits. For greater effectiveness of the toothpaste, it is advisable not to rinse your mouth with water immediately after brushing your teeth to allow the fluoride to settle/fix on the dental surfaces.

The effectiveness of conventional toothpastes with 1000ppm of fluoride has long been demonstrated (17, 57) and it has also been tried that a concentration of 5000ppm of fluorine is able to fight the demineralization of the enamel and facilitate its remineralization even more quickly (58-60). On the other hand, a too rapid and hard remineralization may not be desired in deeper lesions as this process would prevent the penetration of calcium and phosphate ions into the innermost layers of the enamel (14, 15, 61, 62). Due to these observations, it was concluded that the use of substances with a greater initial release of fluoride (burst effect) are more effective in reducing the predisposition of the enamel to demineralization (17, 63); while, on the contrary, to favour a correct remineralization of the enamel, products with a lower concentration of fluorine are more indicated (17, 64).

Agarwall et al. (65) showed that the use of a fluoride toothpaste (Sodium Fluoride EP 0.32% w/w 1450 ppm F, Colgate Total 12, India) for 8 weeks, 3 times a day, is much more effective in remineralizing post debonding WSLs than non-fluoride toothpastes. These results are in agreement with those found by Jo et al. (61) which in a 2014 study showed that toothpastes containing fluoride or casein phosphopeptide amorphous calcium phosphate complex (CPP-ACP) are more effective than a toothpaste containing functionalized β-tricalcium (fTCP) (1).

Following the studies conducted on the subject (66, 67), toothpaste based on fluoride associated with other different active ingredients capable of preventing demineralization and promoting remineralizing have also proved very effective. Mensinkai et al. (66) compared the effects of daily use of a toothpaste with 500 ppm of fluoride associated with ftCP with other toothpastes at different concentrations of fluoride (500 ppm and 1100 ppm) and demonstrated how, along with the combined formula (fluoride + ftCP), there was a better remineralization of the enamel (from 10% to 38% more) and a greater reduction in the depth of the lesions (from 30% to 52%) (1). A 2011 *in vitro* study (67) on the combined Zinc-Fluorine formulas showed how Zinc was able to maintain the surface porosity of the enamel and allow the penetration of fluorine into the deeper layers.

More recent are the toothpastes for daily use that take advantage of NovaMin technology (such as Sensodyne® Repair and Protect) (68, 69). NovaMin is a bioactive glass based on sodium and calcium phosphosilicate and is usually used for the treatment and prevention of dentine hypersensitivity (70). When NovaMin comes into contact with saliva, an exchange of ions takes place which produces an increase in the local PH and favors the formation of hydroxyapatite (69, 71, 72). At the same time the released calcium and phosphate ions form a saturated layer of amorphous calcium phosphate on the tooth surface thus acting as a reserve capable of counteracting demineralization and promoting remineralization (69, 73).

Gokce et al. (74) compared the effects of fluoride-containing toothpaste (Colgate Total®), Novamin-containing toothpaste (Sensodyne® Repair and Protect) and probiotic-containing toothpaste (GD Probiotic Toothpaste®) on artificially produced white spots around brackets applied to extracted molars. They demonstrated that after two weeks of treatment, more fluorescence was obtained with NovaMin toothpaste (1).

In contrast, the study by Ballard et al. (75) found no important differences between the effects

produced by Novamin toothpaste and those based on other active ingredients (1). Moreover, the most recent study by Kijmatgar et al. (69) showed that NovaMin toothpaste does not have a significantly greater remineralizing effect than traditional toothpastes.

However, several studies (60, 76, 77) have shown that the only use of fluoride toothpastes or other toothpastes with remineralizing agents are unable to prevent and repair post-orthodontics white spots lesions, especially the deeper one (14, 17).

CPP-ACP

Relatively recent is casein phosphopeptide amorphous calcium phosphate CPP-ACP, (24) a material derived from milk proteins capable of maintaining a high concentration of calcium and phosphate ions in an amorphous state on the surface of the teeth (18, 78). It is known that the intake of cariogenic substances causes a lowering of the salivary PH. In this acidic environment, the calcium and phosphate ions bound to the tooth surface by this sticky protein (CPP) are released in the saliva and made bioavailable (79, 80); increasing their concentration in the oral cavity helps prevent tooth decay and promote remineralization of the enamel (81-83). Furthermore, this product has been shown to have a buffering effect on plaque and a bacteriostatic effect as it can inhibit the adhesion and growth of *Streptococcus mutans* and *Streptococcus sobrinus* (84, 85). CPP-ACP is commercially available under different formulations such as chewing gum, toothpastes, tablets, sprays and mouthwashes (38) but the best known and most popular are those produced as creams such as Tooth Mousse and MI Paste, both produced by GC (Tokyo, Japan) (84). Since 2002, when it was introduced on the market, Tooth Mousse has become very popular in the practice of pediatric dental professionals not only for the treatment of WSL in children but also for the prevention of caries. It has also proved very useful in adult patients with xerostomia (86).

Several studies have shown that the use of CPP-ACP in combination with fluoride toothpastes is able to improve the remineralizing properties of these two products (17, 66), including older studies by Feagin et al. (87) and Kouolourides et al (88), that had observed an increase in enamel resistance by combining CPP-ACP with fluoride toothpaste, and these results have been confirmed by the most recent studies by Akin et al. (89) and Andressen et al. (90) which show how the daily application of CPP-ACP, twice a day, associated with the use of fluoride toothpastes, is able to guarantee a greater re-mineralizing effect.

CPP-ACFP

The association of CPP-ACP with fluoride in the same product has shown the ability to increase the micro-hardness of the enamel and improve the remineralizing potential of these products (91, 92). In fact, GC has introduced MI Paste Plus (an enriched MI Paste with and additional 900ppm of fluorine) and MI Varnish, a paint based on this compound which in various studies has obtained better effects compared to traditional fluorine paints (18). Through the use of a special disposable brush, a uniform and thin layer of varnish is applied to a dry and clean surface and it is left to act for at least 4 h, inviting the patient to avoid drinking, eating and brushing their teeth in this time (18).

On the other hand, a randomized controlled trial showed that the home application of MI Paste Plus for 3-5 min every evening after brushing teeth, reduced the occurrence of WSL in orthodontic patients more than in controls (93). The contact of this substance with the moist environment of the oral cavity and saliva activates the release of calcium, phosphate and fluorine ions, promoting the formation of fluorapatite crystals (Fig. 5). These are more resistant to acid degradation than the hydroxyapatite crystals that normally make up the enamel, for this reason the remineralized lesions will be more stable and for a longer time (94). Some studies (95, 96), however, did not show significant differences between patients treated with casein derivatives compared to patients who regularly used only toothpastes with 1000 ppm of fluoride.

Infiltration

A minimally invasive technique has recently been introduced to treat cases in which remineralizing substances have proved ineffective. In fact, it has been seen that in the presence of plaque, the

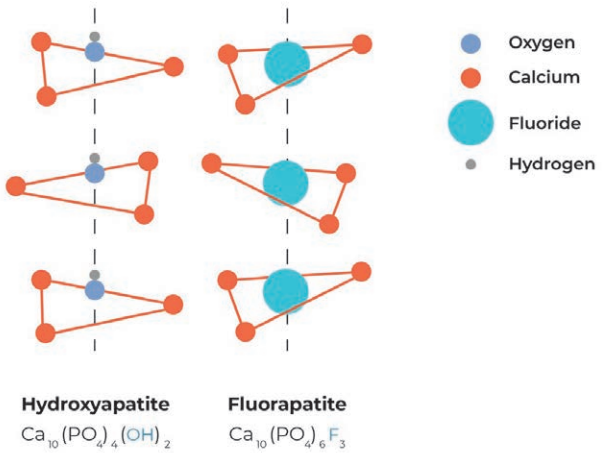

Fig. 5. *When the hydroxyl ions (OH-) of Hydroxyapatite are replaced by fluoride ions (F-) in fluorapatite, the teeth became more resistant to decay.*

remineralization process cannot take place correctly and for this reason the only alternative to improve the appearance of WSL is to use Infiltrations (97). This technique is based on the use of 15% hydrochloric acid to increase the porosity of the surface layer of the enamel followed by the application of a low-viscosity resin (dimethacrylate-based triethylene glycol resin) capable of infiltrating hypocalcified or demineralised enamel microporosities up to 58±37 μm in depth (97, 98). It is now known that this resin has a refractive index of light similar to that of healthy enamel and therefore can improve the appearance of the lesion and to reinforce the weakened structure of the enamel prisms since the first application (25, 99). In fact, this low viscosity resin is able to:

- penetrate into the micropores that characterize the demineralized enamel up to 400 microns deep (100), replacing the enamel prism lost;
- seal and uniform the surface, improving its appearance and protecting it from acid degradation and discolorations;
- stop the demineralization process.

Currently, the most popular commercial product that uses this mechanism is Icon® by DMG, a material first introduced in Germany in 2009. "Icon caries Infiltrant-Smooth Surface" is the formulation indicated for the treatment of WSL after orthodontic treatment (98, 101). Several authors (102-105) agreed in saying that infiltration, in addition to being a minimally invasive and inexpensive technique, is able to improve not only the aesthetics of WSL but to stabilize them over time, avoiding the need for restorative treatment.

There are many products on the market for the prevention and remineralization of WSL. Over the years it has been shown that topical applications of remineralizing agents are more effective than systemic fluoride supplements. For this reason, most of the current studies are dedicated to the introduction of new and effective combinations of substances able to protect and repair damaged enamel. There are remineralizing substances that can be managed independently by the patient at home, others that require the intervention of the dentist. The choice of one of these requires a correct anamnesis of the patient in order to understand his eating and hygiene habits and the degree of collaboration not only in orthodontic therapy but also in the use of support substances to prevent the onset of WSL during the treatment.

In the case of uncooperative patients, it is certainly recommended to choose materials that do not require patient compliance as they have the ability to remain on the tooth surface for a long time and can be applied during properly planned dental visits. Even the infiltrations, unlike the more common pastes based on fluoride or on CPP-ACP and CPP-ACFP, do not require the collaboration of the patient to be effective. For this reason, in recent years, given the encouraging results obtained with these products, their use is increasingly widespread. However, the patient must be reminded that the best method to prevent the onset of WSL during orthodontic treatment is to maintain perfect oral hygiene.

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