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Case Report

Treatment of Labial Enamel White Spot Lesions by Resin Micro-Infiltration

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Abstract

It is not uncommon in our practice to observe white spot lesions (WSLs) because of dental caries, developmental defects of enamel (DDE), dental fluorosis (DF), or post-orthodontic decalcification (POD). Conventional treatment options available include non-invasive and invasive approaches. Recently, a new technology known as "Resin Infiltration" seems to provide an intermediary treatment modality between prevention and restorative therapy. The concept was introduced as a micro-invasive approach for the management of smooth surface and proximal noncavitated carious. This case report illustrates the use of resin infiltration to treat fluorosis stains, exhibiting significant improvement in esthetics.

Keywords: *White Spot Lesions; Dental Fluorosis; Resin Infiltration Technique; ICON*

Introduction

White spot lesions are defined as the subsurface porosity of demineralized enamel that manifests itself as milky white opacities localized on smooth surface [1]. These lesions are observed in dental caries, developmental defects of enamel (DDE), dental fluorosis (DF), and post-orthodontic decalcification (POD).

In the enamel caries lesion that can be clinically recognized for the first time, White spot lesions develop as a result of a dietary carbohydrate and saliva modified bacterial infection, resulting in an imbalance between demineralization and remineralization of the enamel. And these are generally considered to be the precursor of frank enamel carious lesions [2].

Several studies have shown that the orthodontic treatment is a major risk factor for developing white spot lesions. The overall prevalence of these lesions amongst orthodontic patients has been reported as anywhere between 2 and 96 % depending on the methods used to assess and score the extent of decalcification, the presence of decalcification before treatment, and the use of fluoride supplements during treatment [3]. The remineralization of some white lesions is possible, so return either to normal or at last to a visually acceptable appearance. However, white spot lesions may also persist, resulting in an aesthetically unacceptable result [4].

Enamel fluorosis is a porosity in the enamel caused by an overexposure to fluoride during tooth development. It affects teeth during permanent tooth formation, which usually occurs in childhood between the ages of 6 months to 5 years [5]. The chalky appearance of fluorosed teeth reflects the degree of porosity, which varies depending on the fluoride exposure.

Different techniques have been proposed in the aim to improve the appearance of white spot lesions. The usually used are restorative procedures, improvement of remineralization using fluoride or CCP-ACP (Casein Phosphopeptide Amorphous Calcium Phosphate) containing products, microabrasion, argon-laser irradiation [6,7].

The 'resin infiltration technique' was recently introduced with the development of highly-flowable resin material. The following case report describes the effect of resin infiltration technique to mask white spots that was observed in a patient with mild dental fluorosis.

Case Report

A 24-year-old female consults to correct the white lesions on Maxillary anterior teeth.

The clinical examination and the analysis of the patient's medical history show that the stains observed on the labial aspect of teeth 11, 12, 21, 22 are result of a mild enamel fluorosis (Figure 1).

Figure 1: *Mild enamel fluorosis.*

The treatment consists on alternative minimal intervention, avoiding other treatments with more predictable results that would require greater tooth structure reduction, for example macro abrasive or micro abrasive procedures. The enamel infiltration technique with resin infiltrant (Icon, DMG, Germany) was selected for the treatment of this case.

The resin infiltration kit contains 3 syringes (Figure 2), that is the acid gel (ICON Etch), drying agent (ICON Dry), and resin infiltrant (ICON Infiltrant), which were applied respecting the manufacturer's instructions.

Figure 2: *DMG ICON with ICON Etch, ICON Dry and ICON Infiltrant.*

The etching gel contains 15% HCl (Hydrochloric acid), silica, water and additives, the drying agent is ethanol, and the resin infiltrant contains tetra ethylene glycol dimethacrylates, additives and initiators.

The conventional rubber dam was applied to protect soft tissues and achieve clean and dry working conditions (Figure 3). After the tooth surface was cleaned with a rubber cup and prophylaxis paste. The next step consists of accessing the hypomineralized fluorosis lesions. Therefore, the erosion is performed using a gel of 15% hydrochloric acid (Icon-Etch DMG) for 120 seconds to expose the layer of lesion body (Figure 4). Then, the etching gel was thoroughly washed away for 30 seconds using a water spray (Figure 5). To desiccate the lesions, ethanol was used (ICON-Dry; DMG) for 30 s followed by air drying (Figure 6). An infiltrant resin (ICON_-Infiltrant; DMG) was applied to the surface and allowed to penetrate inside for 3 min (Figure 7). Excessive material was wiped away using a cotton roll from the surface before light curing. Excessive resin in the proximal spaces was cleaned using dental floss. After light curing for 40 s (Figure 8), the application of infiltrant resin was repeated once for 1 min and light cured for 40 s. Finally, the roughened enamel surface was polished using a composite resin polishing discs. An improvement in the esthetic appearance was achieved (Figure 9).

Figure 3: *Application of conventional rubber dam.*

Figure 4: *Erosion of the surface layer with 15% HCl (Icon-etch, DMG).*

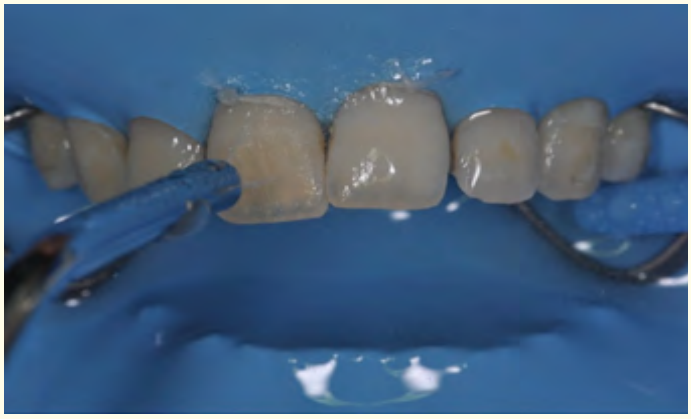

Figure 5: *The etching gel is thoroughly washed away (30 seconds) using water spray.*

Figure 6: *Lesions desiccated by application of ethanol (Icon-dry, DMG) for 30 seconds and air-drying.*

Figure 7: *Application of the resin infiltrant for 3 minutes (Icon-infiltrant, DMG).*

Figure 8: *After removal of surplus material, the area is light-polymerized for 40 seconds.*

Figure 9: *Before and after treatment. Improvement in this case was considered successful.*

Discussion

White spot lesions are detected frequently, patients that have esthetic concerns could find it problematic. The subsurface porosity in the enamel below a well-mineralized surface layer is the cause of white spot appearance. These lesions are more obvious when the teeth are dry because of the different refractive indices of enamel, water, and air. Natural enamel has a refractive index of 1.62. Enamel becomes porous when demineralized. If the pores within the lesion are filled with water (refractive index: 1.33), the lesions will appear opaque compared to the sound tissue. If dried, the air replaces water in the pores (refractive index 1.0), and the lesion becomes more visible [8].

The typical appearance of mild fluorosis is small white opaque flecks; these flecks are more visible near the incisal edges of the anterior teeth, superimposed on a general lack of translucency. Treatment is conventionally done using enamel microabrasion, this technique re-created the outer, prism-free region and teeth became glassy and named 'abrosion effect'. This layer reflects or scatters the light, so it masks mild imperfections. However, we often need to erode substantial amounts of enamel to improve appearance with this technique [2].

Resin infiltration technique was found to be an effective treatment for masking white spot lesions in vitro and in vivo. The concept of caries infiltration was first developed at the Charité Berlin and the University of Kiel as a micro-invasive approach for the management of smooth surface and proximal non-cavitated caries lesions [9]. In the ICON technique, the infiltrants used are light curable resins which

were developed for immediate penetration into the capillary structures of the lesion body. These materials are characterized by a very low viscosity, high surface tension, and low contact angles to the enamel. These material properties are important to complete penetration of the resin infiltrant into the lesion body of the enamel caries [10].

However, the mineralized intact surface layer hampers the resin from penetrating into the lesion. For this reason, this layer is removed by acid etching with 15% hydrochloric acid gel. Application of hydrochloric acid as an etchant has been demonstrated to be superior to 37% phosphoric acid gel in removing the surface layer of natural enamel lesions when applied for 120 seconds. Moreover, we can consider this technique truly microinvasive, unlike enamel microabrasion, because only 30 - 40 µm are eroded [10].

The principle of masking enamel lesions by resin infiltration is based on changes in light scattering within the lesions [11]. The novel technique used involves the infiltration of the enamel lesions with resin (RI 1.46) that, in contrast to the watery medium, cannot evaporate. This makes the difference in refractive indices between enamel and porosities to be negligible, so lesions appear similar to the surrounding sound enamel. Lesions lose their whitish opaque color and blend reasonably well with surrounding natural tooth structure [12]. Thus, a prompt improvement in the esthetic appearance was observed.

If we compare with enamel microabrasion or conventional restorative techniques, resin infiltration seems to be much less invasive, and only negligible tooth substance must be sacrificed by etching and polishing [11]. It's important to know that the esthetic outcome of resin infiltration cannot be precisely predicted, as in some bleaching and enamel microabrasion techniques, but it usually leads to a considerable improvement in appearance, even if all whitish parts of a lesion do not completely disappear [13].

Conclusion

Minimally invasive techniques without anesthesia or drilling are increasingly requested by patients. The resin micro infiltration is a micro invasive treatment of smooth-surface white spot lesions, it allows a natural recovery of tooth appearance and it is always possible to shift to more invasive restorative procedures in case of failure of resin infiltration. Certainly, patient's motivation plays a major role in the success of any minimal invasive dentistry technique.

Conflicts of interest

There are no conflicts of interest.

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