



Case Report

Aesthetic Improvement of White Spot Fluorosis Lesions with Resin Infiltration

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Abstract

Dental fluorosis changes the colour and/or structure of enamel, leading to an unaesthetic appearance. One of the main goals in the treatment is aesthetic improvement of the affected teeth. Two clinical cases of patients with white spot fluorosis lesions on frontal teeth are presented. All treated teeth are infiltrated with low-viscous light-curing resin (ICON, DMG). A significant improvement in the aesthetic appearance of all the treated tooth surfaces is visible immediately after resin infiltration, and in most of the teeth - a complete disappearance of the white spots. Resin infiltration is an alternative micro-invasive approach for treatment of white spot lesions of different origin. It allows a quick and natural recovery of the affected teeth.

Keywords:

white fluorosis lesions, resin infiltrant

INTRODUCTION

Dental fluorosis is a disturbance in enamel development caused by overexposure to fluoride during enamel formation. It is characterized by disrupted mineralization resulting in increased enamel porosity. Beneath the relatively well mineralized outer surface layer, there is a diffuse hypomineralization layer or porosity which clinically leads to aesthetic deviation corresponding to the severity of dental fluorosis.¹ The severity of the disease depends on the dose and duration of fluoride intake and the age of the individual during exposure.

Because of the free access to mineral waters and fluoride products for prevention and control of dental caries, clinicians are facing an increasing number of patients with dental fluorosis.² In Bulgaria, Kukleva studies the problems of fluoro-prophylaxis and the possibilities of fluoride over-

dosing in the modern way of life.³ Fluorosis changes the colour and/or structure of enamel, leading to an unaesthetic appearance of the teeth. It varies from small white spots or mottled patches to brown spots and irregularities, to a combination of spots, pits and/or structural breakdown of the enamel surface.¹

One of the main aims in the treatment of dental fluorosis is aesthetic improvement of the affected teeth. The treatment options depend on the severity of the condition and can be non-operative and operative. They include bleaching, microabrasion, veneers and crowns.^{1,4} Since the introduction of the method of resin infiltration for non-operative treatment of non-cavitated caries lesions of smooth surfaces, the literature on its application for aesthetic improvement of white fluorosis lesions is increasing exponentially.

Aim

The aim of this article is to present an alternative micro-invasive approach to the treatment of white spot fluorosis lesions through their infiltration with low-viscous light curing resin.

CLINICAL CASES

Two clinical cases of patients with white fluorosis spots on anterior teeth are discussed. Both patients were treated using the resin infiltration method (ICON, DMG). Resin infiltration includes etching the enamel surface and sealing the lesion with a low-viscous highly penetrating light-curing resin. The infiltration kit consists of 3 syringes and special applicators – an etching gel (ICON Etch), a drying agent (ICON Dry) and an infiltrant (ICON Infiltrant) (**Fig. 1**).

Resin infiltration is applied in accordance with the manufacturer's instructions:

1. Rubber dam or gingival barrier is placed for soft tissues protection and complete isolation. In the cases presented, sectional rubber dam is used (Mini Dam, DMG).
2. Tooth surfaces are cleaned with a polishing paste and brush/rubber cup.
3. Application of ICON Etch, containing 15% hydrochloric acid for 120 seconds. This step removes the superfi-

cial enamel layer and lets the infiltrant completely penetrate the hypomineralised pores of the fluorosis lesions.

4. Rinsing the etching agent with water spray for 30 seconds.

5. Drying the lesions with ethanol (ICON Dry) for 30 seconds followed by air drying. The ethanol desiccates the lesion body and removes the water retained in the microporosity of enamel lesion. If there is no change in colour and no disappearance of the white spot during the alcohol application, this means the white spot will not disappear after the infiltrant application. In such cases, etching is repeated.

6. Application of the infiltrating resin (ICON Infiltrant, DMG – contains triethylene glycol dimethacrylate), which is left to penetrate under the action of the capillary forces for 3 minutes.

7. Removal of the excessive material with cotton rolls and dental floss for the interproximal spaces.

8. Light curing of the resin for 40 seconds.

9. Second application of the infiltrant for 1 minute.

10. Light curing of the infiltrant for 40 seconds.

11. Polishing the treated surfaces with a polishing paste and polishing brushes/disks.

A significant improvement in the aesthetic appearance of all the treated tooth surfaces is visible after resin infiltration, and, in most of the cases, a complete disappearance of the white spots.

Clinical case 1

A 24-year-old woman from Hissarya, coming from a family with a good social status. Her mother did not take fluoride tablets during pregnancy, but had always consumed Hissar mineral water used for preparing the food for the family. The patient reported taking Hissar mineral water (fluoride content of 5 mg/L) regularly throughout her whole life. She took no fluoride drops or tablets as a child. At examination, white spots on nearly all teeth and slight brownish pitting of the occlusal parts of the vestibular surfaces of upper first premolars were visible (**Figs 2, 3, 4**). In terms of the localization, form, and patient's history, the white spots on the buccal surfaces of the incisors were classified as fluorosis with score 1 to 2 and the canines as fluorosis with score 2 to 3 according to Thylstrup and Fejerskov index. Differential diagnosis was performed with initial caries lesions, molar incisor hypomineralization, mild forms of enamel hypoplasia, trauma or infection of the primary teeth. The patient denied having any common diseases, genetic disorders, trauma or infection experience, medication intake or orthodontic treatment. The patient asked for improvement of the aesthetic appearance of the upper anterior teeth. For aesthetic considerations, the upper incisors and canines were infiltrated with resin. The white spots disappeared in all teeth but the upper right canine, in which there was only partial change. Nonetheless, a significant improvement was visible (**Fig. 5**). The 18-month follow up showed stable results (**Fig. 6**).



Figure 1. Infiltration kit for smooth surfaces.



Figure 2.



Figure 3.



Figure 4.

Figures 2, 3, 4. The patient before the infiltration – the dental fluorosis affects the whole dentition.

Clinical case 2

A 13-year-old girl from a family with a high social status. There was a history of fluoride tablets intake (Zymafluor) by the mother during pregnancy and breastfeeding. The patient herself also took Zymafluor drops and later tablets in prophylactic dose regularly in her early childhood with some breaks, but also took local mineral water ('Devin' mineral water with fluoride content of 4 mg/L) occasionally, as well as drank fluoridated milk from time to time. The same mineral water was used for preparing the food for the family. On the clinical examination, white spots on the upper central incisors in the area of the incisal edge with well-defined borders were visible. These were diagnosed as mild fluorosis score 1 to 2 according to Thylstrup and Fejerskov index (Fig. 7). Initial caries lesions, molar incisor hypomineralization, mild forms of enamel hypoplasia, trauma or infection of the primary in-



Figure 5. After the infiltration.



Figure 6. 18-month follow up.

cisors were taken into consideration in the differential diagnosis. The mother and the child asked for aesthetic improvement as the girl was feeling uncomfortable because of the white spots. Resin infiltration was performed on the central incisors. The white lesions were masked after the procedure (Fig. 8). The one-year follow up showed stable results (Fig. 9).

DISCUSSION

The alteration in aesthetic perception caused by fluorosis, depending on its severity, can generate frustration, embarrassment and concern when smiling, as well as potential impact on the quality of life of adults and children. The patient's self-assessment is crucial for choosing a treatment option. There are studies that have demonstrated that poor degrees of involvement are not a problem for some patients and no treatment is needed.³ In the presented cases



Figure 7. White fluorosis spots of teeth 11 and 21 before the treatment.

the fluorosis lesions represented mild fluorosis, but caused aesthetic concern in the patients who insisted on masking them. Having in mind the young age of the patients, the least invasive method of treatment was chosen. Resin infiltration for masking white spots of different origin shows promising in vitro and in vivo results.⁵⁻⁹ The concept of caries infiltration was developed in Charite Berlin as a micro-invasive approach in the treatment of non-cavitated carious lesions on smooth tooth surfaces.¹⁰ The aim of the treatment is to seal the micropores in the body of the lesion through their infiltration with low-viscous light curing resins, optimised for quick penetration in the body of the lesion, driven by capillary forces. Infiltrants are characterized by low viscosity, high surface tension and little contact angles with enamel.¹⁰⁻¹² Due to these qualities of the resin, infiltrants quickly and completely penetrate in the body of the lesion, thus creating a diffusion barrier within the lesion, not on its surface (in contrast to dental adhesives). The resin, polymerized within the lesion, additionally mechanically stabilizes it.^{10,11,13}

The highly mineralized pseudo-intact surface layer prevents the resin from penetrating into the lesion. That is why this layer is removed by acid etching with 15% hydrochloric acid for 120 s. Application of hydrochloric acid as an etchant has been demonstrated to be superior to 37% phosphoric acid, as the latter cannot remove the surface enamel layer.^{10,14} When Icon-Dry is applied after etching, the lesion should appear less whitish opaque due to the penetration of the ethanol into the lesion's porosities. If this effect is not visible, it most often indicates that the lesion should be etched again because the surface layer has not been eroded completely.¹² In both presented cases, triple etching was necessary to achieve optimal and satisfactory results.

A positive effect from the resin infiltration is the loss of the whitish appearance of the spots when the micropores are filled with resin and blend with the surrounding sound enamel. The effect of masking enamel lesions by resin infiltration is based on the principle of light scattering within the lesion. The sound enamel has a refractive index of 1.62 (RI). The micropores in the enamel lesions are filled with water (RI=1.33) or air (RI=1.0). The difference in the refractive indices of the enamel crystals and the medium in the micropores causes light scattering, the result of which is the whitish appearance of these lesions. The micropores of the infiltrated lesions are filled with resin (RI=1.52), which 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.¹⁰ Additionally, improvement in aesthetic appearance of lesions is immediately observed after infiltration in the same visit of the patient.

Resin infiltration of white spot lesions is the least invasive technique in comparison to the conventional methods.¹⁵ In fact, it is considered a truly micro-invasive procedure, and the quantity of removed enamel is only a few microns (30-40 μm), because of the etching and polishing.^{5,10,12} However, the final outcome of resin infiltration cannot be pre-



Figure 8. After the infiltration – almost complete masking of the white spots.



Figure 9. 12-month follow up.

cisely predicted. Nonetheless, this procedure usually leads to a significant aesthetic improvement in the appearance of teeth, which satisfies patients, even if all parts of the white lesion do not completely disappear.⁷

In terms of stability of the aesthetic result, few short-term clinical studies have been conducted with a maximum follow-up of 12 months, where the aesthetic improvement of the lesions appears to be stable over time.^{9,16-18} In the present study stable results and no colour change or any complications were observed after 12 and 18 months. However, the infiltrant can absorb some dyes such as coffee, tea and red wine.^{19,20} Patients should be informed about this fact and be careful with the consumption of such foods and drinks. Strict control at certain intervals is necessary and if discoloration is present, repolishing can be considered.²⁰

CONCLUSION

The minimally-invasive techniques without anaesthesia or drilling are more and more desired by patients nowadays. Resin infiltration is an alternative approach for treatment of white spot lesions of different origin, including fluorosis. It allows a quick and natural recovery of the affected teeth. The technique takes less time and finances than the other methods of treatment. In a case of unsatisfactory results, it is possible to easily shift to a more invasive approach. The relatively small number of studies requires additional re-

search on resin infiltration as a micro-invasive treatment of fluorosis spots, as well as longitudinal follow up of the results in a long term aspect.

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Эстетическое улучшение белых флюорозных поражений путём инфильтрации смолы: представление двух случаев

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Абстракт

Флюороз зубов изменяет цвет и / или структуру эмали, что приводит к неэстетическому внешнему виду. Одной из основных целей лечения является эстетическое улучшение поражённых зубов. Представлены два клинических случая пациентов с белыми пятнами, вызванными флюорозом передних зубов. Все обработанные зубы были пропитаны фотополимеризационной смолой с низкой вязкостью (ICON, DMG). Значительное улучшение эстетического вида всех обработанных зубов стало очевидным сразу же после инфильтрации смолы, и на большинстве зубов беловатые пятна полностью исчезли. Смоляная инфильтрация является альтернативным микроинвазивным подходом для лечения белых пятен различного происхождения. Это позволяет быстро и естественно восстановить поражённые зубы.

Ключевые слова

белые флюорозные поражения, инфильтрант смолы
