

## RESIN INFILTRATION AS A MINIMAL INVASIVE ESTHETIC TREATMENT FOR A MILD FLUOROSIS CASE

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### ABSTRACT

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**Aim:** The present case report aimed to describe a minimally invasive method to mask the white opaque lesions of enamel in a mild fluorosis case (Dean's Index code 3) to improve its esthetic outcome.

**Summary:** Dental fluorosis (DF) is a developmental disturbance of enamel caused by excessive ingestion of fluoride on ameloblasts during enamel formation. The clinical manifestations depend on the severity of fluorosis. In mild cases, there are white opaque striations across the enamel surface, whereas in more severe cases, the porous regions increase in size, with enamel pitting, and secondary discoloration of the enamel surface. Patients often suffer from the discoloration and the pitted surface of the teeth which are the major characteristics leading to an unaesthetic appearance. A minimally invasive treatment approach of in-office bleaching followed by a resin infiltration technique was applied to enhance the porous fluorosed enamel surface. The combination of the two techniques resulted in a perfectly satisfactory aesthetic outcome with a clinical follow-up for 12 months.

**Key learning points:** fluorosis, minimal invasive approach, bleaching, resin infiltration, esthetic.

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### 1. Introduction

Enamel pathologies like enamel hypoplasia, amelogenesis imperfecta and dental fluorosis occur as a result of disturbances during the last stage of sound enamel formation. In the maturation stage; the ameloblasts lose their protein secretory properties due to increased growth activity [1]. Dental fluorosis is caused by excessive intake of fluoride in drinking water during enamel formation [2]. When the fluoride concentration is 1 ppm, fluorapatite is formed instead of hydroxapatite which has more protein content, is hypermineralized and thereby has increased appetite crystallinity. The clinical manifestations of dental fluorosis depend on its severity [3]. In mildest fluorosis form, the enamel is characterized by white lines that represent accentuated perikymata or rod ends. The white lines maybe confluent or discrete areas with white lines in between. However, in moderate dental fluorosis cases, the entire enamel surface maybe chalky white and the sub-surface porosities may attract extrinsic stains and cause enamel discoloration. In sever dental fluorosis cases post-eruptive trauma of the extensive subsurface porosity enamel surface causes detachment and pitting enamel surfaces [4].

The treatment option of dental fluorosis depends on its severity as well. For severe fluorosis cases, invasive approaches such as resin composite veneers, ceramic veneers, or ceramic crowns, are generally chosen. But for mild to moderate fluorosis cases more conservative treatment options are preferred. In addition to the

microinvasive treatment approach (micro or macro abrasion) other ultra- minimal invasive treatment options such as bleaching and resin infiltration technique should be considered [5].

Patients with fluorosed teeth usually complain of the unaesthetic appearance of teeth and seek aesthetic treatments. The unaesthetic fluorosed teeth discoloration maybe due to enamel hypomineralization and the subsequent extrinsic stains into the porous subsurface enamel that range from yellowish, light brown to dark brown or black. This type of discoloration could be treated by in-office or at home bleaching or a combination of both using different bleaching agents. Hydrogen peroxide and carbamide peroxide are the commonly used bleaching agents [6].

A resin infiltration technique was developed for the treatment of incipient caries lesions by using a low-viscosity resin that fills the porous structure of the carious lesions and when light cured can stop caries, inhibit further demineralization and mask white spot lesions. The resin infiltration technique showed good applicability and high acceptance by dentists [7-9].

The purpose of this article is to discuss the clinical result with a 12-month follow-up of a mild fluorosis case treated by resin infiltration proceeded by dental bleaching.

### 2. Case Report

A 23-year old male patient presented to the Conservative Dentistry Department at Istanbul



Figure 1. Mild fluorosis, Dean's Index code 3.



Figure 2. The patient's teeth after bleaching with 35% Hydrogen peroxide gel.



Figure 3. Preoperative view, teeth were isolated by rubber dam.



Figure 4. 15% HCl acid gel application.



Figure 5. 100% Ethanol dehydration, Alcohol index.



Figure 6. Resin infiltration application.



Figure 7. Resin infiltrant polymerization.



Figure 8. Resin infiltration re-application.



Figure 9. Resin infiltrant polymerization.



Figure 10. Resin infiltration re-application.

University complaining of unaesthetic appearance of his teeth due to the presence of white lesions and discoloration. After his clinical examination this patient was diagnosed as mild fluorosis Dean's index code 3. (Fig. 1).

For this patient a combination of in-office bleaching and resin infiltration was planned. First, one session in-office bleaching was applied to the patient using the 35% Hydrogen peroxide bleaching gel (Whitness HP, FGM, Joinville, SC, Brazil) (Fig. 2).

Resin infiltration was applied according to the manufacturer's instructions; first the teeth were cleaned and polished. Then rubber dam and floss were

used for isolation (Fig. 3).

The bleached fluorosed enamel surface was etched with 15% HCl gel (ICON etch<sup>®</sup>, DMG) for 2 minutes (Fig. 4) as instructed by the manufacturer.

After etching, the enamel surface was rinsed with air-water spray for 30 s, dried, and then dehydrated with 100 % ethanol (ICON dry<sup>®</sup>, DMG) for 30 s (Fig. 5).

Alcohol is an efficient visual examination way to control the effectiveness of penetration capacity of the etched enamel by its high infiltrative capability. When 100% Ethanol (ICON dry<sup>®</sup>, DMG) used the white spot lesions on the fluorosed enamel surface should have almost disappeared as a result of porous lesions, otherwise the

etching step should be repeated.

Resin infiltration (ICON®, DMG) was applied on the etched surface using the applicator with rubbing for 2 minutes, then one should wait 1 minute before the surface is slightly dried with compressed air for 10 s. (Fig. 6).

Then it should be light-cured for 40 s (Fig. 7) and reapplied for 1 minute more to compensate the polymerization shrinkage (Fig. 8).

Changes were evident and immediate improvement could be observed after resin infiltration in this case (Fig. 9). The aesthetic outcome improvement and durability could be observed 12 months after the treatment (Fig. 10).

### 3. Discussion

Discoloration stands as the main concern of patients suffering from fluorosis and the reason why they seek treatment. Regarding mild fluorosis, bleaching is indicated to enhance the natural appearance of the discolored superficial porosities (mean depth approx. 200 µm). If the lesion displays deeper porosities in conjunction with the entrapped extrinsic stains then it should be removed by micro or macro abrasion depending on the surface characteristics of the lesion that should be taken in consideration. However, some fluorosis cases reveal deep subsurface porosities (300 µm) which could not easily be removed by minimal invasive treatment methods. In these cases, resin composite or porcelain veneer restorations could be indicated as an invasive treatment modality. Considering much more severe cases existing more than 50% of fluorosed enamel surface with loss of enamel and compromised remaining substrate structure, the adhesion capacity of the dental hard tissues threatens the adhesive efficiency thus crowning of the tooth could be considered [10].

The basic philosophy of minimally invasive dentistry is the integration of prevention, remineralization and minimal intervention for placement or replacement of restorations [11]. The aim of minimal invasive intervention is tissue preservation by prevention of the disease, intercepting its progression and applications of treatment techniques with the possible least tissue loss [11]. With respect to the present fluorosis case treatment outcome, an outstanding aesthetic improvement had been achieved immediately following bleaching and resin infiltration treatment, which both are considered as minimal invasive treatment approach. These treatment approaches are especially tailored for young patients with optimum oral health care, sound non-carious teeth without any pathological signs or further periodontal abnormalities.

The discoloration of mild fluorosed enamel could be enhanced by in-office or at-home bleaching or a combination of both. Bleaching aims to match the color and opacity difference of the natural unaffected portion of enamel structure and the opaque white spot lesions part of the affected enamel surface by exerting camouflage effect [6,12,13]. The camouflaging effect tries to elevate the opacity of the bleached enamel thus lowering the contrast of the distinction of the unaffected and effected enamel [13].

The resin infiltration technique was considered a novel approach of dental fluorosis when compared to the other treatment options [14]. The resin infiltration system (ICON) was produced by DMG company (Hamburg, Germany) for non-cavitated carious lesions in proximal and smooth surfaces in which the resin seals the lesion and works as a barrier on the lesions surface [16,17]. This technique aims to fill the subsurface lesions porosities (with depth up to 450 µm) by the low-viscosity and high penetration coefficient resin [17]. Before the application of the resin infiltrant the carious lesions surface should be prepared by an acid etch agent to eliminate the hypermineralized superficial layer (average thickness 30 - 40 µm) and allow the resin to infiltrate deep into the subsurface porosities. Usually 2 minutes of 15% HCl acid is used for this purpose [18]. In addition to caries progression inhibition resin infiltration could be indicated to enhance and restore the natural enamel appearance of enamel surface in cases of fluorosis and enamel hypoplasia. The resin infiltrant has a refractive index (RI = 1.62) similar to that of sound enamel furthermore allowing the masking effect over the subsurface enamel porosities [19]. In this case a combination of two treatment options were applied for the discolored mild fluorosis teeth, first in-office bleaching using 35 % hydrogen peroxide was applied. Thus, it was possible to attenuate the contrast between the opaque white spot lesions part and the healthy luminous enamel parts. For some instances, the camouflaging effect could be adequate for satisfying the patients. But when bleaching is not sufficient as demonstrated in the present case, resin infiltration could be chosen in consequence. However, since the infiltration would be in conjunction with the bleaching, it is mandatory to wait for two weeks before application of the resin infiltrant in order not to interfere with the resin curing capability [20].

The resin infiltrant penetration capacity into the carious lesions had been investigated in many in vitro studies and had shown almost complete penetration depth [21,22]. However, the histopathological features of enamel affected by fluorosis, especially the presence of hypermineralised surface layer reduces the penetration capacity of the resin infiltrant into the subsurface lesions body of the fluorosed enamel. The resin infiltration penetration depth was limited in moderate fluorosis and a little higher in mild fluorosis teeth [23]. Many clinical studies have demonstrated the efficacy of resin infiltration technique in arresting carious lesions as well as improvement in esthetics of white spot lesions, fluorosis, MIH and other enamel hypoplasia stains [9,24-26]. The aesthetic improvement was noted over time, but this might be as a result of water absorption by resin, which was not completely removed by ethanol. This absorption reduces the optical interfaces in the light path. The aesthetic outcome of many clinical cases followed for more than 12 months showed adequate durability [9,25].

### 4. Conclusions

In this case, a 12-month follow-up of the resin infiltration technique after bleaching showed a satisfying outcome

with enhanced aesthetic and function. Thus, resembling a minimal invasive treatment approach, a combination of resin infiltration technique following bleaching should be considered for the treatment of such mild fluorosis teeth. It is considered as an economic and effective solution. Furthermore, beside the expanded recall intervals to evaluate the treatment outcome, in vitro studies are also required to discuss the effect of the bleaching agents on the penetration depth of the resin infiltrant into the lesions and its effect on the fluorosed enamel surface mechanical properties.

### Author contributions

RO: contributed to the case treatment, follow-up control, data collection, analysis and drafting the manuscript; HŞS: contributed to the design of the work, treatment plan, analysis of data, revising the draft for important intellectual content and giving the final approval for the version to be published.

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## Questions

### 1. Which are the clinical manifestations of mild fluorosis enamel:

- a. Confluent or discrete white lines on the enamel surface;
- b. Chalky white smooth enamel surface;
- c. Chalky white enamel surface with sub-surface porosities;
- d. Chalky white pitted enamel surface with stains and discoloration.

### 2. Resin infiltration technique is used for all except:

- a. Smooth surface incipient caries treatment;
- b. Pit and fissure incipient caries treatment;
- c. Dental fluorosis;
- d. Enamel hypoplasia.

### 3. The resin infiltrant (ICON) has a refractive index which is similar to:

- a. Water;
- b. Enamel;
- c. Air;
- d. Dentin.

### 4. In this case, we assessed:

- a. The efficacy of the invasive treatment approach in dental fluoroses cases;
- b. The efficacy of bleaching camouflage on mild fluorosis teeth;
- c. The efficacy and durability of a combination of bleaching and resin infiltration technique in mild fluorosis case;
- d. The treatment options based on dental fluorosis severity.



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