

CASE REPORT

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Management of Enamel Hypomineralization with
Resin Infiltration Technique: A Clinical Case Report

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Manejo de hipomineralización del esmalte
con técnica de infiltración de resina: Reporte de caso clínico

Soner Şişmanoğlu DDS, PhD¹

1. Department of Restorative Dentistry, Faculty of Dentistry, Altınbaş University, Istanbul, Turkey.

Correspondence to: Dr. Soner Şişmanoğlu - soner.s@hotmail.com

ABSTRACT: Defects that occur during the development of anterior teeth are often associated with aesthetic problems. Although enamel hypomineralization does not significantly increase the risk of caries, it causes patients to experience psychosocial problems. A 23-year-old female patient presented to our clinic complaining of white opacity and discolorations in her anterior teeth. After the systemic and dental anamnesis of the patient, minimally invasive treatment of resin infiltration was planned. In addition, anterior composite resin restorations with impaired color matching was renewed. The patient was recalled 13 months after the treatment. A significant decrease was observed in the appearance of enamel hypomineralizations. The patient was satisfied with the outcome of the treatment. Furthermore, the durability of the treatment after 13 months is satisfactory.

KEYWORDS: Adhesive dentistry; Fluorosis; Minimally invasive dentistry; Resin infiltration.

RESUMEN: Los defectos que ocurren durante el desarrollo de los dientes anteriores a menudo se asocian con problemas estéticos. Aunque la hipomineralización del esmalte no aumenta significativamente el riesgo de caries, causa que los pacientes experimenten problemas psicosociales. Una paciente de 23 años se presentó en nuestra clínica quejándose de opacidad blanca y decoloraciones en sus dientes anteriores. Después de la anamnesis sistémica y dental del paciente, se planificó un tratamiento mínimamente invasivo con infiltración de resina. El paciente fue atendido por control post-operatorio 13 meses después del tratamiento, se observó una disminución significativa en la aparición de hipomineralizaciones del esmalte con un resultado estético y de longevidad clínica satisfactorio.

PALABRAS CLAVE: Odontología adhesiva; Fluorosis; Odontología mínimamente invasiva; Infiltración de resina.

INTRODUCTION

The formation of enamel defects has a broad range etiology including systemic, local and environmental factors. The quality and quantity of enamel formation was influenced by the etiologic factors during the enamel development depending on the stage of amelogenesis and duration of these factors. Often these defects appear as white colored manifestations with increased opacity, which have an important effect on dental appearance (1). Developmental enamel defects are divided into two as enamel hypoplasia and enamel hypomineralization. Enamel hypoplasia presents as scarce and quantitative defect, whereas enamel hypomineralizations are alterations in enamel translucency and opacity due to a qualitative defect in the enamel (2,3). Qualitative deficiency in the enamel produces different refraction indices in the tooth and deviates incoming light beams to the observer; therefore, appears as white spot lesions (4,5). The most common enamel defects are initial caries demineralization (white spot lesion), traumatic hypomineralization, molar-incisor hypomineralization, and fluorosis (6-8).

The presence of evident white areas on the tooth surface is due to the defect completely in

the enamel and the dentin is not influenced (7). Healthy enamel is the most highly mineralized tissue in the human body and 96% by weight is hydroxyapatite. In the presence of a white spot, the situation changes and the ratio of the mineral phase decreases and is replaced by organic liquids (7). For this reason, the defect resulting from modifications in the chemical composition of the enamel frequently defined as enamel hypomineralization.

Dental fluorosis, which appears as white and brown spots, is frequently ignored condition by the clinicians besides the importance given to the prevention of dental caries (9). However, these discolorations on the enamel surface can sometimes cause serious psychological problems that would make children want to drop out the school (7,10,11). In a European multi-center study among children aged 8 years, the prevalence of less severe lesions was reported to range from 28% to 61%, whereas the prevalence of severe manifestations were reported only 4% (12). In a recent clinical study, the presence of 31% fluorosis in permanent teeth of 9-year-old children was found (13). Thereby, dental fluorosis, nowadays, a condition in which dentists may coincide approximately one-third of their patients in the clinic that requiring aesthetic treatment.

Regardless of etiology, all of these white defects histologically appear as hypomineralization (7). In the treatment of hypomineralization, remineralization (14,15), bleaching (16,17), enamel micro-abrasion (18,19), macro abrasion (20,21), resin infiltration (9,22,23), restorative treatments or combination of these treatments (24,25) can be applied. Successful results can be achieved with all these treatment options, but it is important to define the indication correctly. Hypomineralizations are enamel lesions that can be seen in different thicknesses at different locations (7,26,27). There are several classifications such as Dean's Index, Tylstrup and Fejerskov index, Tooth Surface Index of Fluorosis (TSIF) are used for defining the severity of fluorosis (7). TSIF classifies the coronal involvement and clinical appearance rather than the etiology of the lesion (Table 1). According to this classification, lesions between TSIF 1-4 are defined as less severe stages and involvement of the outermost layer is generally observed. Hence, minimally invasive treatment option beneficial both for the patient and the clinician. On the other hand, TSIF >4 is defined as advanced stages and secondary modifications such as the presence of cavitation are seen. Minimally invasive treatment options alone will not provide satisfactory results (7).

The resin infiltration technique was developed for use in the treatment of initial caries lesions (28,29). In the initial caries lesions, as in enamel hypomineralization, alterations occur in the chemical composition of the enamel. The low viscosity resin fills the porous structure on the enamel surface and prevents further demineralization. Furthermore, infiltrated resin masks the appearance of white spot lesions. Therefore, it has been quickly accepted by many dentists as a minimally invasive treatment (30-32). The aim of this article is to discuss the clinical outcome of a mild fluorosis case treated with resin infiltration with a 12-months follow-up.

CASE REPORT

The patient signed the informed consent of this case report.

A young female patient (aged 24) referred to the Restorative Dentistry Department at Istanbul University complaining of unpleasant appearance her anterior teeth with white spots and discolorations (Fig.1,2,3).



Figure 1. Initial situation. The patient complained of white spots and discolorations in the anterior region.



Figure 2. Grayscale photograph of the initial situation to evaluate the extent of the lesions.



Figure 3. Intra oral photograph of the initial situation.

In the first appointment, the patient's medical and dental history was taken. According to the patient history, the patient does not have any systemic disease or allergy and does not taking regular medication. There were no pathological findings after clinical and radiographic examinations and hence, the patient had no contraindications for treatment. Following the characterization of discolorations and history of the patient were examined, the patient was diagnosed as TSIF stage 4 (Table 1).

Table 1. Tooth Surface Index of Fluorosis.

Stage	Clinical criteria
0	No sign of fluorosis
1	Fluorosis is limited to the cusp tips with a snowy-white occlusal cap on the molars
2	White parchment-like appearance on less than 2/3 of the enamel surface
3	White parchment-like appearance on at least 2/3 of the enamel surface
4	Discolored areas with patches ranging from very pale to dark brown
5	Slight stippling with discoloring of pits
6	Slight stippling with change of enamel color
7	Pits merge forming wide areas of dark brown enamel alongside areas where the enamel is no longer present

First, professional oral hygiene treatment was performed to remove as much as the extrinsic staining. After a rubber-dam placement (Fig.4), enamel micro-abrasion treatment was carried out for the tooth number 21 to remove surface layer of enamel due to the lesion with higher opacity. Micro-abrasion session was performed by a water-soluble paste containing hydrochloric acid and abrasive particles (Opalustre, Ultradent, South Jordan, UT, USA). A small amount of paste was applied to the lesion in tooth 21 and then micro-abrasion was performed by contra-angle handpiece under gentle pressure for 60 seconds with specific rubber cups (OpalCups, Ultradent, South Jordan, UT, USA) provided with micro-abrasion set.



Figure 4. After the professional hygiene treatment. Rubber-dam isolation.

Thereafter, a resin infiltration (ICON, DMG, Hamburg, Germany) was performed in accordance with the manufacturer's recommendations. Firstly, 15% hydrochloric acid (ICON-Etch; DMG, Hamburg, Germany) was applied to the tooth surfaces and waited for 2 minutes. After the removal of etchant, tooth surfaces were dehydrated with pure ethanol (100% ethanol; ICON-Dry; DMG, Hamburg, Germany) to observe effectiveness. Most of the lesions two session of hydrochloric acid etching was effective. However, the tooth number 21 was further acid etched due to its intense discoloration (4 times in total). Then the infiltrating resin (ICON-Infiltrant; DMG, Hamburg, Germany) was applied to the dried enamel surfaces with its applicator for 2 minutes. In order to compensate the polymerization shrinkage and possibility of discoloration, one coat of resin reapplied for 1 minute and polymerized under glycerin gel. To finish the treatment all tooth surfaces treated with resin infiltration were polished using a polishing paste (Diamond Polish, Ultradent, South Jordan, UT, USA). Immediately after the treatment, positive results were noticed, almost all of the discolorations are lost (Fig.5,6).

In the second appointment, both the resin infiltration procedure was checked (Fig.7) and the approximal composite restorations in teeth 21 and 11, which were disturbing the patient by the aesthetic appearance, were renewed with nano-composite (Filtek Ultimate Restorative, 3M ESPE).

The composite restoration in tooth number 22 just refurbished (Fig.8). The patient left the clinic very satisfied with the treatment results (Fig.9). The aesthetic outcome of this minimally invasive treatment could be observed 13 months after the treatment (Fig.10).



Figure 5. The immediate results of the resin infiltration treatment.



Figure 6. 1-week results of the resin infiltration treatment (extraoral view).



Figure 7. 1-week results of the resin infiltration treatment (intraoral view).



Figure 8. After the replacement of old composite restorations (intraoral view).



Figure 9. Final results. Due to dehydration, whiteness is observed in some areas.



Figure 10. 13-month follow-up.

DISCUSSION

Discoloration and hypomineralization of the anterior teeth affect the aesthetic appearance of patients and patients frequently complain about this condition. This problem causes physical and social problems in patients (7,10,11). Hypomineralization affects the optical properties of the tooth, such as translucence, opacity and fluorescence, and can be treated with a variety of restorative procedures (33). Conservative approaches such as whitening, micro-abrasion and composite resin restorations

may be preferred in the treatment of mild defects, while combinations of these treatments may be preferred in more intense forms of these defects.

The use of resin infiltration as a new method in superficial enamel hypomineralization where cavitations are not observed and only the optic properties of the tooth are affected is highly accepted. This treatment is based on the penetration of low viscosity resin to hypomineralized enamel tissue and eliminating the appearance of opaque lesion (34). Resin infiltrant is a low viscosity, light-curing material that forms a low contact angle to enamel and can infiltrate into the lesion body as a result of its high surface tension (30). To facilitate this, hydrochloric acid gel is first applied to the lesion (30,34,35) and the resin infiltrant penetrates into the lesion with the help of capillary forces (36). After penetration, an appearance similar to the sound enamel is obtained due to the reduction in lesion opacity (37,38). Although this material has been developed for the treatment of initial caries lesions, success in the treatment of caries without caries has expanded the use of this material for this indication.

Compared to other restorative options, resin infiltration is a less invasive method that only affects the hypomineralized enamel (35,39). In addition, the fact that it does not require local anesthetic administration and provides a single-session solution with lower cost compared to complex treatment procedures increases the popularity of this treatment. However, long-term clinical trials are needed to prove the durability and efficacy of new therapies to improve the knowledge of clinicians.

CONCLUSION

In this case report, the unpleasant appearance of the lesions was finally removed and the aesthetic expectations of the patient were met in a minimally invasive manner. In such cases, the

patient's aesthetic and functional problems should be solved and the patient should be offered the most conservative treatment option in order to restore psychosocial self-confidence. Many factors such as age, socioeconomic status, type and severity of the lesion should be taken into consideration in treatment planning.

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