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Dental Fluorosis Treatment: Three Case Reports

Dental Florozis Tedavisi: Üç Olgu Sunumu

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ABSTRACT

Objectives: Systemic exposure to high fluoride concentrations during tooth development can induce dental fluorosis, a developmental condition of the enamel that can cause mild-to-severe tooth discoloration and substance loss. Today, the number of patients who complain of this type of discoloration applied to dental clinics has increased. Especially in regions with >1 ppm fluoride in drinking water, this amount is quite high. In this case, the results obtained by using one or more of the methods such as microabrasion, dental bleaching, resin infiltration, restorative treatment are satisfactory. By providing patients with an aesthetic smile, it helps them to be more self-confident in their social lives. The aim of this case report is to clinically follow the results of different treatment options applied to three patients diagnosed with fluorosis who presented to our clinic with aesthetic complaints.

Case Report: In this case report, the diagnosis, treatment and follow-up processes of three different patients who applied to our clinic in the province of Kırıkkale, one of the endemic fluorosis regions were presented.

Conclusion: Microabrasion treatment can be considered as an alternative to invasive treatments that cause substance loss in teeth.

Keywords: Dental bleaching, Dental fluorosis, Microabrasion

ÖZET

Amaç: Dental florozis, diş gelişimi sırasında sistemik olarak yüksek konsantrasyonlarda florür maruziyetinin sebep olduğu, dişlerde hafiften şiddetliye doğru farklı oranlarda renklenmelere ve madde kayıplarına yol açabilen minenin gelişimsel bozukluğudur. Günümüzde bu tip renklenmelerden şikayetçi olan hastaların kliniklere başvurma sayısı artmıştır. Özellikle içme sularında >1 ppm'den fazla florür bulunan bölgelerde bu sayı oldukça fazladır. Bu durumda mikroabrazyon, diş beyazlatma, rezin infiltrasyon, restoratif tedavi gibi yöntemlerden bir veya birkaçını kullanarak elde edilen sonuçlar memnun edicidir. Hastalara estetik bir gülümseme sağlanarak sosyal hayatlarında daha özgüvenli olmalarına katkıda bulunulur. Bu olgu sunumunun amacı, estetik şikayetle kliniğimize başvuran florozis tanısı konulmuş üç hastada uygulanan farklı tedavi seçeneklerinin sonuçlarını klinik olarak takip etmektir.

Olgu Sunumu: Bu olgu sunumunda, ülkemizin endemik florozis bölgelerinden Kırıkkale ilinde bulunan kliniğimize başvuran üç farklı hastanın teşhis, tedavi ve takip süreçleri ele alınmıştır.

Sonuç: Mikroabrazyon tedavisi dişlerde madde kaybına neden olan invaziv tedavilere bir alternatif olarak düşünülebilir.

Anahtar Kelimeler: Dental Beyazlatma, Dental Florozis, Mikroabrazyon

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Introduction

Dental fluorosis is a disorder that arises during the production of tooth enamel as a result of consuming fluoride above the daily optimum dose (1ppm: 1mg/L).¹ It affects the enamel during the late secretory and maturation phases, forming subsurface

porosities.² Fluorosis causes chalky white regions or discoloration on the tooth surface ranging from yellow to dark brown, as well as considerable material loss on the enamel surface.³ The Thylstrup and Fejerskov Index (TFI) is the most generally used index for fluorosis classification, illustrated in Table 1.⁴

Table 1. Thylstrup and Fejerskov Index⁴

| Score | Criteria |
|-------|--|
| 0 | Enamel retains its normal translucency even after a protracted air-drying period. |
| 1 | Narrow white lines that corresponding to the perikymata. |
| 2 | Smooth surfaces: Opacity lines that are more prominent and follow the perikymata. An occasional convergence of adjacent lines. Occlusal surfaces: Dispersed opacity regions. |
| 3 | Smooth surfaces: Overlapping and asymmetrically hazy opacity regions. Perikymata drawn with emphasis, which is frequently seen in between opacities. Occlusal surfaces: Zones of significant opacity confluent. A ring of opaque enamel frequently encircles worn portions, which seem nearly normal. |
| 4 | Smooth surfaces: The entire surface has a powdery white appearance or shows noticeable opacity. Surface areas subjected to attrition seem to be less impacted. Occlusal surfaces: The entire surface is noticeably opaque. Attrition is frequently noticeable soon after eruption. |
| 5 | Smooth surfaces and occlusal surfaces: The entire surface exhibits focused loss of outermost enamel (pits) and significant opacity. |
| 6 | Smooth surfaces: Pits are consistently grouped in horizontal bands with a vertical extension of less than 2 mm. Occlusal surfaces: Enameled regions with a diameter of less than 3 mm show enamel loss. Significant attrition. |
| 7 | Smooth surfaces: External enamel loss in erratic patches that cover less than half of the surface. Occlusal surfaces: Morphological alterations brought on by pit overlapper and significant attrition. |
| 8 | Smooth and occlusal surfaces: More than half of the outermost enamel is lost. |
| 9 | Smooth and occlusal surfaces: Loss of the majority of enamel together with a change in the surface's anatomical appearance. It is common to observe nearly unaffected enamel on the cervical rim. |

Fluorosis can be treated using macroabrasion, microabrasion, vital dental bleaching, the resin infiltration technique, and their combination applications, such as laminate veneers and crowns.⁵ Since fluorosis patients usually consult dentists at a young age, minimally invasive treatments like microabrasion, vital dental bleaching, and resin infiltration are frequently preferred.⁶

The purpose of this case report was to clinically monitor the outcomes of the combined application of different treatment options such as macroabrasion, microabrasion, dental bleaching and restorative treatment in three patients diagnosed with fluorosis who presented to our clinic with aesthetic complaints.

Case Reports

Case I

A 25-year-old female patient presented to the Kirikkale University Faculty of Dentistry Department

of Restorative Dentistry with a complaint of yellow-brown discoloration on her teeth. During the medical history, it was determined that she was born and lived in Kirikkale, which is considered a high-risk area for fluorosis. Upon intraoral examination, prominent yellow-brown stains were observed, particularly on the upper and lower anterior teeth. Some teeth exhibited an opaque white appearance and there were cavities on tooth surfaces. According to TFI, the fluorosis score was found to be five. The patient was provided with informed consent forms and her signature was obtained. The initial intraoral dental photographs were taken and their records were obtained (Fig. 1a).

At the beginning of the treatment, after applying a rubber dam (Fig. 1b), controlled macroabrasion was performed on the buccal surfaces of the teeth using extra fine needle diamond bur (Frank Dental; Gmund

am Tegernsee, Germany) under water cooling for 5-10 seconds (Fig. 1c). Subsequently, a water-based chemical and mechanical abrasion paste containing 6.6% hydrochloric acid and silicon carbide microparticles (Opalustre, Ultradent Products, UT,

USA) was applied to the tooth surfaces, and a bristle brush cup (Oralcups Bristle, Ultradent Products, UT, USA) was applied to each tooth under gentle pressure at 500-600 rpm for 60 seconds (Figure 1d and 1e).

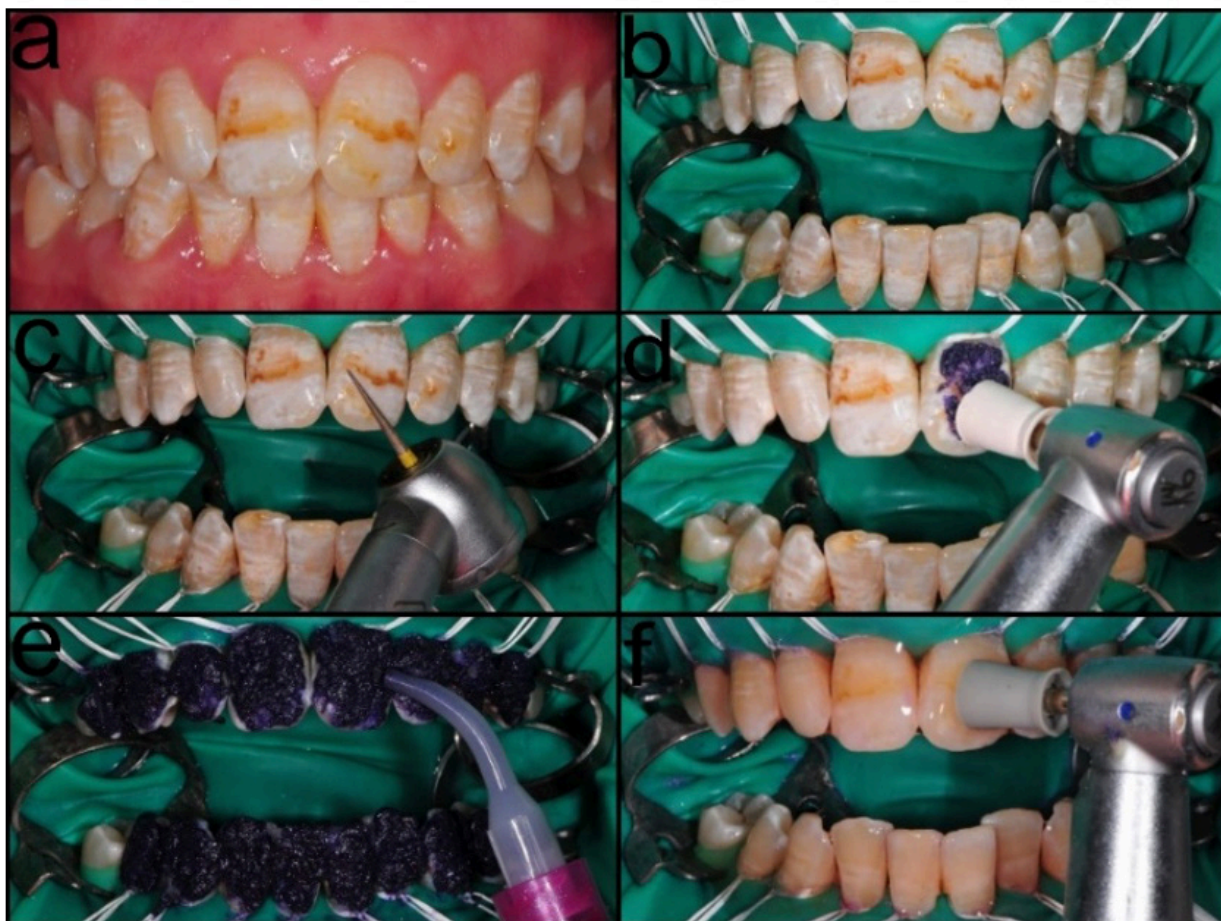


Figure 1. a. Initial, b. isolation achieved with rubber dam, c. macroabrasion procedure, d. application of Opalustre (Ultradent) 6.6% hydrochloric acid gel with OpalCups Bristle rubber, e. teeth treated with Opalustre (Ultradent) 6.6% hydrochloric acid gel, f. fluoride application with OpalCups finishing rubber after the microabrasion procedure.

At the end of the procedure, a topical fluoride application was performed for four minutes using a polishing cup (Oralcups Finishing, Ultradent Products, UT, USA), (Fig. 1f). The microabrasion procedure was repeated three more times at one-week intervals. After the fourth clinical session, the appearance of the teeth was shown in Figure 2a. In the second stage, dental bleaching treatment was applied. After the microabrasion procedure, the dentin tissue shows more color due to the thinning of the remaining enamel. Therefore, bleaching treatment was performed after microabrasion treatment. Low-concentration home bleaching was preferred to minimize the possibility

of tooth sensitivity caused by the more permeable enamel surface. Initially, the color of the teeth was determined as A2 using a shade guide (Vita Classical, Vita Zahnfabrik, Bad Säckingen, Germany), (Fig. 2b). After the preparation of bleaching trays, the patient was instructed to use a bleaching agent containing 10% carbamide peroxide (Opalescence PF 10%, Ultradent Products, UT, USA) according to the manufacturer's instructions for eight hours per night for two weeks (Fig. 2c). Following the home bleaching treatment, the final color of the teeth was recorded as A1 (Fig. 3a). The patient was fully satisfied with the treatment outcome (Fig. 3b).



Figure 2. a. After four clinical sessions, b. color measurement before at-home bleaching treatment, c. two weeks of application of at-home bleaching with 10% carbamide peroxide.

After the six-month follow-up and 18-month follow-up, it was observed that the color stabilization of the teeth was preserved (Fig. 3c and 3d). However, there was a dental plaque on the teeth with gingival bleeding. Oral hygiene motivation and necessary recommendations were given to the patient. Long-term clinical follow-up of the case will continue.



Figure 3. a. Color measurement after at-home bleaching treatment, b. color change after at-home bleaching treatment, c. 6-month follow-up, d. 18-month follow-up.

Case II

A 22-year-old male patient presented to our clinic with aesthetic complaints related to brown discoloration on his upper anterior, 1st, and 2nd premolar teeth. During clinical examination, it was determined that the patient had previous composite resin restorations

on his anterior teeth, and a diagnosis of score four fluorosis according to TFI was made. Informed consent was obtained from the patient, and initial intraoral photographs were taken. Subsequently, microabrasion treatment was administered in two sessions, as described in the first case (Fig. 4a and 4b). At the end of the microabrasion treatment, topical fluoride was applied as in the first case. Then, office bleaching treatment was performed at the second appointment. After the patient was informed about home and office bleaching, the patient stated that he could not do home bleaching treatment, and office bleaching was applied as a result of the patient’s own preference. The buccal surfaces of the teeth were treated with a one mm thick office bleaching agent containing 40% hydrogen peroxide (Opalescence Boost, Ultradent Products, UT, USA) following the application of the gingival barrier (OpalDam, Ultradent Products, UT, USA), (Fig. 4c). After applying the chemical to the tooth surface for 20 minutes, an aspirator was used to remove it. This application was repeated twice; the teeth were rinsed with water, and the gingival barrier was removed with a probe (Fig. 4d).



Figure 4. a. Initial, b. after microabrasion procedure, c. in-office bleaching treatment, d. after in-office bleaching treatment.

As shown in Figure 5a, after the bleaching procedure, the old restorations were replaced after two weeks with A2 shade of Filtek Z250 (3M ESPE, St. Paul, USA). Intraoral photographs were taken during the treatment and follow-up appointment one week later. At the six-month follow-up (Fig. 5b), there was no marginal discoloration in the restorations. However, at the 12-month follow-up, plaque accumulation due to poor oral hygiene and discoloration in the restorations were observed (Fig. 5c). In addition, a minor fracture in the restoration of the right central tooth was discovered, which was assumed to be

caused by the patient's occlusion. After beveling the broken line with an extra fine needle diamond bur (Frank Dental; Gmund am Tegernsee, Germany), it was etched for 30 seconds with 37% orthophosphoric acid (Condac37; FGM, Joinville, Brazil). Following that, universal adhesive (Single Bond Universal; 3M ESPE, Neuss, Germany) was used. Following the composite repair of the fractured restoration, the occlusion control and polishing procedures were performed. Long-term clinical follow-up of the case will continue.



Figure 5. a. After treatment with composite laminates, b. 6-month follow-up, c. 12-month follow-up.

Case III

A 17-year-old female patient presented to our clinic with aesthetic complaints related to brown discoloration on her upper anterior teeth. According to the TFI score, three fluorosis were diagnosed. The patient's parents signed the informed consent form. Initial photographs were obtained before treatment, and microabrasion therapy was applied as described in the first case under rubber dam isolation (Fig. 6a). The procedure was carried out twice on the teeth until the discoloration was eliminated (Fig. 6b). At the end of the microabrasion treatment, topical fluoride was applied as in the first case. The patient was recommended bleaching treatment; however, due to financial reasons, this procedure was not

performed. At six and 12 months, clinical follow-up examinations were done (Fig. 6c and 6d). The patient expressed her pleasure with the dental aesthetics throughout these follow-up visits, and no color change was seen in comparison to the pretreatment state.



Figure 6. a. Initial, b. after microabrasion procedure, c. 6-month follow-up, d. 12-month follow-up.

Discussion

The presence, intensity and depth of yellow-brown stains or opaque lesions on teeth are crucial for accurate treatment planning.⁷ The diagnosis of dental fluorosis, which effectively explains the biological changes in enamel, is necessary to determine the appropriate treatment method. For mild fluorosis with TFI scores of 1-2, bleaching treatment may be suitable, while moderate fluorosis with TFI scores of 4-5 may require microabrasion, which involves the acidic removal of affected enamel. For cases with TFI scores of five and above, microabrasion may be combined with composite restorations or porcelain laminates. In severe fluorosis cases with TFI scores of 8-9, crowning the teeth may be preferable, as discoloration may be difficult to remove using minimally invasive techniques.⁸ In our cases, the diagnoses and treatments aligned with the protocol. In the first case, microabrasion and bleaching treatment were sufficient and no restoration was needed, whereas in the second case, the affected teeth were restored with composite laminates. A previous study discovered that topical fluoride polishing following microabrasion increased enamel hardness and enhanced surface smoothness.⁹ In order to utilize the advantages of topical fluoride applied after microabrasion treatment, topical fluoride application was performed following microabrasion treatment in three cases. In some cases, vital bleaching treatment may be recommended after microabrasion to achieve a more perfect aesthetic outcome.¹⁰ Microabrasion can remove enamel up to

25 to 250 µm deep, making the dentin more visible and potentially darkening the tooth color.¹¹ Fluorosis-affected teeth have a hard enamel layer that prevents bleaching agents from penetrating deeper enamel layers, because of that bleaching is applied after the abrasion with hydrochloric acid and silicon carbide.¹² However, it is recommended to wait for a few weeks after microabrasion to allow the enamel surface to remineralize before bleaching.¹³ In both case I and case II, bleaching treatment was applied after microabrasion to achieve a whiter smile. To mask the white opaque appearance in fluorosis patients, resin infiltration can be performed after microabrasion and bleaching.¹⁴ However, resin infiltration was not chosen in these cases due to the difficulty of the clinical follow-up of color changes that may occur after resin infiltration treatment and the cost of the treatment procedure. Microabrasion has proven to be an effective, low cost, easy, and conservative technique that permanently eliminates internal stains, influencing its preference in these cases.¹⁵ For long-term success and to observe the outcomes of treatments like microabrasion and resin infiltration in dental fluorosis cases, controlled studies, and regular patient follow-up are essential.

Conclusion

In conclusion, microabrasion treatment can be considered as an alternative to invasive prosthetic treatments that cause substance loss in teeth. Achieving results while preserving the natural structure of the teeth is satisfying for both the patient and the dentist in the long term.

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Conflicts of Interest

None of the authors of this article has any relationship, connection or financial interest in the subject matter or material discussed in the article.

Authors' Contribution

Concept/Idea: H.M. Design: H.M. Supervision/ Consultation: Ç.Ç. Analysis and/or Interpretation: H.M., Ç.Ç. Literature Search: H.M., B.B.E Manuscript Writing: H.M., B.B.E, Ç.Ç. Critical Review: Ç.Ç.

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