©Operative Dentistry, 2013, **38-4,** 358-362

Minimally Invasive Treatment for Esthetic Management of Severe Dental Fluorosis: A Case Report

Y Wang • Y Sa • S Liang
T Jiang

Clinical Relevance

The proposed technique may be a promising alternative to restorative treatment of teeth with severe dental fluorosis.

†Yining Wang, DDS, PhD, professor, The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST) & Key Laboratory of Oral Biomedicine Ministry of Education, School & Hospital of Stomatology, Wuhan, China

†Yue Sa, DDS, PhD candidate, The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST) & Key Laboratory of Oral Biomedicine Ministry of Education, School & Hospital of Stomatology, Wuhan, China

Shanshan Liang, DDS, PhD, The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST) & Key Laboratory of Oral Biomedicine Ministry of Education, School & Hospital of Stomatology, Wuhan, China

*Tao Jiang, DDS, PhD, professor, The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST) & Key Laboratory of Oral Biomedicine Ministry of Education, School & Hospital of Stomatology, Wuhan, China

*Corresponding author: The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST) & Key Laboratory of Oral Biomedicine Ministry of Education, School & Hospital of Stomatology, Wuhan University, 237 Luoyu Road, Wuhan 430079, China;

e-mail: jiangtao2006@whu.edu.cn

†Yining Wang and Yue Sa contributed equally to this case report.

DOI: 10.2341/12-238-S

SUMMARY

Dental fluorosis is a developmental disturbance of enamel caused by excessive fluoride on ameloblasts during enamel formation. Patients often present to the dentist with a main goal of improving their esthetic appearance. This case report describes a minimally invasive technique for treating a severe case of enamel fluorosis with brown surface aspect and small defects. A selective mega-abrasion and microabrasion were used to recreate macro- and micro- surface morphology, followed by power bleaching, home bleaching, and resin infiltration to improve the esthetic appearance.

INTRODUCTION

Dental fluorosis (DF) is a developmental disturbance of enamel caused by excessive fluoride on ameloblasts during enamel formation.[1] Based on the excellent work of Dean *et al* in the 1940s,[2,3] a strong relation was found between fluoride concentration in

Figure 1. *Initial view of a patient with severe DF.*

drinking water and the prevalence and severity of DF.[4] Because of its important role in the prevention and control of dental caries, fluoride has also been added to milk and salt in recent decades.[5,6] As a result, clinicians are facing an increasing number of patients with DF.[6] DF affects the color and/or structure of enamel, which leads to an unpleasant esthetic appearance.

The treatment plan for DF depends on the severity of disease.[4,7] In cases of severe DF, invasive approaches, such as resin composite restorations, ceramic veneers, or even crowns, are generally chosen. However, the loss of tooth structure weakens its mechanical properties. Thus, especially for young patients, invasive procedures accelerate the destruction of tooth at an early age. Moreover, the aforementioned treatments are relatively expensive. For these reasons, more conservative approaches that are cheaper and less time consuming should be proposed for severe DF.

Figure 2. *Mega-abrasion performed with a 105-μm fine diamond bur.*

Figure 3. *Surface finishing. (Sof-Lex discs, 3M ESPE)*

The aim of this article is to introduce a minimally invasive treatment for improving the esthetic appearance of teeth afflicted with severe DF.

CLINICAL CASE REPORT

A 28-year-old woman came to our prosthodontics department to improve her dental esthetics. She had been experiencing severe discoloration and surface defects on the anterior teeth for more than 10 years. Clinical assessment revealed that the DF was severe and had a significant impact on the esthetic appearance of the teeth (Figure 1).

Considering the patient's young age, more conservative treatment was proposed to improve the condition of her teeth instead of the conventional restorative approaches. The proposed treatment was based on a combined approach of enamel abrasion, tooth bleaching, and resin infiltration for managing the enamel surface and periodontal scaling to prevent inflammation and improve the gingival status before the formal treatment.

First, mega-abrasion was performed using a high-speed handpiece with a 105-μm fine diamond bur (ML524, Diatech, Altstatten, Switzerland) to remove the superficial 200–400 μm enamel (Figure 2). After that, medium to fine abrasive discs (Sof-Lex, 3M ESPE, St Paul, MN, USA) were used to reshape the enamel surface and remove the sharp angles (Figure 3). Subsequently, a photopolymerizable resin dam (Beyond Technology Inc, Santa Clara, CA, USA) was applied (Figure 4), and a small amount of abrasive paste (Opalustre, Ultradent Products, South Jordan, UT, USA) containing silicon carbamide microparticle paste and 6.6% hydrochloric acid was painted on the affected teeth. The tooth surfaces were then micro-abraded using a specific rubber cup (Oralcups,

Figure 4. *Photopolymerizable resin dam. (Beyond Technology Inc)*

Ultradent Products) with slight pressure for about 120 seconds (Figure 5).

After microabrasion, an in-office bleaching agent (Opalescence Boost, 38%H_2O_2 Ultradent Products) was performed to alleviate the dark brown tooth color (Figure 6). Then a desensitizing agent (Fluorinated protector, Beyond Technology Inc) was painted and left undisturbed on the surfaces of bleached teeth for five minutes (Figure 7). Subsequently, agent removal with suction, thorough water rinsing, and removal of the photopolymerizable rubber dam were conducted (Figure 8). To better harmonize color, at-home bleaching was suggested to the patient. After applying eight syringes of 10% carbamide peroxide (Ultradent Products), the patient was satisfied with the bleaching effect (Figure 9).

Considering the hypomineralization structure of DF, a standard resin infiltration approach (Icon, DMG Products, Hamburg, Germany) was performed

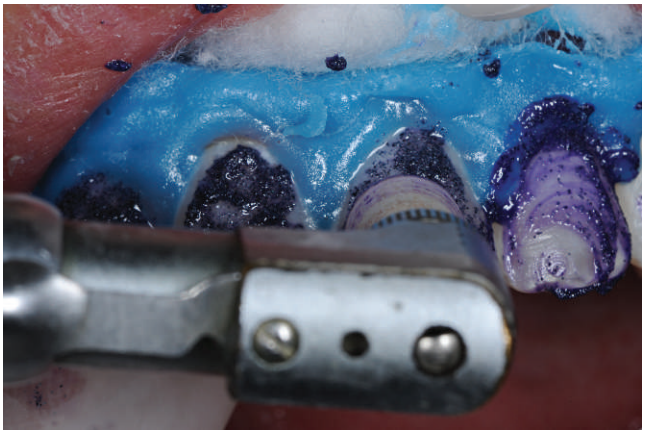

Figure 5. *Microabrasion. (Opalustre, Ultradent Products)*

Figure 6. *Application of an in-office bleaching agent. (38% H_2O_2, Ultradent Products)*

to prevent potential enamel caries two weeks after at-home bleaching therapy (Figure 10). Finally, improvement of the esthetic appearance was achieved and remained stable until the 12-month follow-up (Figure 11).

DISCUSSION

The etiology of DF seems to be well known. Excessive consumption of fluoride during critical ages disturbs enamel mineralization, inhibits enamel apatite crystal growth, and interferes with the degradation of enamel matrix proteins, which results in a whitish-brown enamel aspect of the defect of enamel structure, depending on the severity of the DF.

Initial mega-abrasion was chosen to remove the superficial layer of fluoride enamel that displayed the most unesthetic color and defective structure. This procedure eliminated deeper stains in the

Figure 7. *Application of desensitizing agent. (Fluorinated protector, Beyond Technology Inc)*

Figure 8. *Facial view after removal of the photopolymerizable rubber dam.*

Figure 10. *Facial view after application of the resin infiltration. (Icon, DMG Products)*

enamel and minimized the clinical chair time.[6,8] It has been postulated that even 25% to 33% enamel reduction would probably be unrecognizable and clinically acceptable.[9] Therefore, well-controlled mega-abrasion could be considered as an acceptable approach in severe cases of DF without an unnecessary sacrifice of hard dental tissue.

To produce whiter teeth and harmonize tooth color, microabrasion and vital tooth bleaching were applied subsequent to mega-abrasion. In addition, a fluoride application was performed directly after the in-office bleaching to eliminate potential dental sensitivity.

The involvement of resin infiltration was a novel approach compared with previous DF treatments. The reasoning for this choice was based on the structure of fluorosed enamel and the properties of resin infiltration. In general terms, fluorosed enamel includes areas of diffuse hypomineralization and porosities in the subsurface enamel.[10] When the superficial layer of fluorosed enamel is removed by mega-abrasion and microabrasion, the subsurface enamel is exposed to the air. Then enamel pores act as pathways for bacterial and acid.[11] Thus, filling these pores would be an effective prevention therapy for potential caries. Because the resin infiltrant showed a very low viscosity, low contact angles to enamel, and high surface tensions, it could penetrate porosities and rapidly occlude the pathways.[12] Moreover, because of the similar refractive indices of resin and enamel, resin infiltration would improve the white opaque appearance of pores and reduce the original contrast between pores and enamel caused by light scattering,[13] thus leading to the esthetic appearance of enamel.

The proposed technique cost much less than conventional treatment approaches for severe DF. For instance, an all-ceramic veneer is about 10 times

Figure 9. *Facial view after applying eight syringes of 10% carbamide peroxide. (Ultradent Products)*

Figure 11. *Patient's appearance at the 12-month follow-up.*

more expensive than the proposed technique if considering the material cost and chair-side time.

CONCLUSIONS

Treatment with enamel abrasion followed by tooth whitening and infiltration application seems to be a minimally invasive therapy for severe DF. Moreover, this treatment is cheaper and less time consuming for patients.

Conflict of Interest

The authors of this article certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

(Accepted 8 August 2012)

REFERENCES

1. Alvarez JA, Rezende KM, Marocho SM, Alves FB, Celiberti P, & Ciamponi AL (2009) Dental fluorosis: exposure, prevention and management *Medicina Oral Patologia Oral y Cirugia Bucal* **14(2)** E103-E107.
2. Dean HT, Jay P, Arnold FA Jr, & Elvove E (1941) Domestic waters and dental caries. II. A study of 2832 white children aged 12–14 years of eight suburban Chicago communities, including *L. acidophilus* studies of 1761 children *Public Health Report* **56** 761-792.
3. Dean HT, Arnold FA Jr, & Elvove E (1942) Domestic water and dental caries. V. Additional studies of the relation of fluoride domestic waters to dental caries experience in 4425 white children aged 12–14 years of 13 cities in 4 states *Public Health Report* **57** 1155-1179.
4. Ardu S, Stavridakis M, & Krejci I (2007) A minimally invasive treatment of severe dental fluorosis *Quintessence International* **38(6)** 455-458.
5. Aoba T, & Fejerskov O (2002) Dental fluorosis: chemistry and biology *Critical Reviews in Oral Biology & Medicine* **13(2)** 155-170.
6. Ardu S, Benbachir N, Stavridakis M, Dietschi D, Krejci I, & Feilzer A (2009) A combined chemo-mechanical approach for aesthetic management of superficial enamel defects *British Dental Journal* **206(4)** 205-208.
7. Akpata ES (2001) Occurrence and management of dental fluorosis *International Dental Journal* **51(5)** 325-333.
8. Benbachir N, Ardu S, & Krejci I (2007) Indications and limits of the microabrasion technique *Quintessence International* **38(10)** 811-815.
9. Dalzell DP, Howes RI, & Hubler PM (1995) Microabrasion: effect of time, number of applications, and pressure on enamel loss *Pediatric Dentistry* **17(3)** 207-211.
10. Fejerskov O, Thylstrup A, & Larsen MJ (1977) Clinical and structural features and possible pathogenic mechanisms of dental fluorosis *Scandinavian Journal of Dental Research* **85(7)** 510-534.
11. Paris S, Meyer-Lueckel H, & Kielbassa AM (2007) Resin infiltration of natural caries lesions *Journal of Dental Research* **86(7)** 662-666.
12. Paris S, Meyer-Lueckel H, Colfen H, & Kielbassa AM (2007) Penetration coefficients of commercially available and experimental composites intended to infiltrate enamel carious lesions *Dental Materials* **23(6)** 742-748.
13. Paris S, & Meyer-Lueckel H (2009) Masking of labial enamel white spot lesions by resin infiltration—a clinical report *Quintessence International* **40(9)** 713-718.