

Conservative aesthetic management of dental fluorosis using microabrasion with two different acidic compounds in pediatric patients: A report of two cases

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Highlights

Dental fluorosis can severely impact the aesthetics and social life of pediatric patients. Effective management is crucial for improving the confidence and overall well-being of affected children.

Microabrasion using two different acidic compounds demonstrated significant improvement in the aesthetic appearance of teeth affected by dental fluorosis.

This study provides comparative insights into the efficacy of two acidic compounds in treating dental fluorosis, aiding clinicians in choosing best treatment for pediatric patients.

Abstract

Dental fluorosis is a subsurface hypomineralization condition, characterized by yellow to dark brown stains, with or without enamel porosity and pitting. Due to aesthetic concerns, children with discolored anterior teeth often experience negative impacts on their psychological, emotional, and social development. Treatment options include porcelain laminates or veneers, direct resin restorations, and crowns. However, these methods are invasive and require significant enamel reduction, making them unsuitable for children due to their enlarged pulp chambers. Microabrasion is the least invasive and safest treatment for children with fluorosis. This technique involves using a combination of 37% phosphoric acid gel with extra fine grain pumice, 18% hydrochloric acid in pumice, or 6.6% and 10% hydrochloric acid with silica carbide particles. The mixture is applied with a slowly rotating rubber cup to the areas of discoloration or white opacities. An additional benefit of microabrasion is that it leaves the enamel surface highly polished, reducing the growth of cariogenic bacteria and increasing resistance to demineralization. This case report describes two instances of dental fluorosis treated with microabrasion using different acidic compounds in two pediatric patients, resulting in clinically acceptable and aesthetically pleasing outcomes.

Keywords: Dental Fluorosis; Enamel Microabrasions; Esthetics; Preventive Dentistry

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INTRODUCTION

Dental fluorosis (DF) is a developmental disorder of enamel caused by a prolonged intake of excessive fluoride during enamel formation, causing pathological alterations in ameloblasts, preventing the development of normal hydroxyapatite crystals clinically characterized by exterior hypermineralization and subsurface hypomineralization.¹ Despite the well-known fact that water fluoridation is a safe and effective public health strategy for lowering the incidence of dental caries, excess fluoride in drinking water, above a concentration of 0.5-1.5 mg/l, can cause metabolic changes in ameloblasts, resulting in a defective matrix and insufficient calcification of teeth, known as dental fluorosis.^{2,3}

Several treatments have been proposed to improve the appearance of DF, including the use of veneers or full crowns, composite restoration, microabrasion, bleaching, and/or resin infiltration.¹ The severity of the condition determines which techniques are to be used. As most DF patients are young, prosthetic therapy like full coverage crowns are invasive procedures that causes excessive sacrifice of tooth material, that may lead to complications like pulpal exposure.⁴ A less invasive aesthetic procedure, such as microabrasion, is therefore more appropriate for mild-moderate DF management. However, if the depth of the defect is greater, microabrasion in conjunction with bleaching or bonded restorations can be used to provide optimal aesthetics.^{3,5} Although bleaching, a non-abrasive technique, is widely accepted for removal of stains, bleaching agents impacts the tooth surface chemically because of their low pH and chelating agents, creating surface topographic enamel irregularity, such as depressions, surface porosity, and surface abnormalities rendering the dentin more vulnerable to post-operative teeth sensitivity.^{6,7} This can worsen in cases of dental fluorosis due to

presence of subsurface hypomineralization and thereby deeper penetration of the bleaching agents.^{8,9}

The microabrasion technique is a minimally invasive and definitive technique that involves the application of a mixture of 37% phosphoric acid gel in extra fine grain pumice, 18% hydrochloric acid in pumice, or 6.6% and 10% hydrochloric acid with silica carbide particles to areas of discoloration using a rubber cup in a slow rotating motion.¹⁰

In the present case report, two patients with Dean's fluorosis score of 4 (moderate DF) were treated with the minimally invasive esthetic technique of microabrasion, using 34% H₃PO₄ and 18% HCl respectively, followed by fluoride application; and subsequent composite application on the labial surface of anterior teeth.

CASE REPORT

CASE 1

A 9-year female reported to the Department of Pediatric Dentistry with a chief complaint of discoloration of the upper front teeth. Her father noticed this discoloration since she was seven years of age, affecting her appearance and smile. On recording history, it was noted that she lived in Agra, Uttar Pradesh, a fluoride endemic region.^{11,12} Further exploration of family history revealed that her elder brother had more severe discoloration of front teeth. On examinations her teeth displayed irregular chalky white and brown spots in the permanent maxillary and mandibular incisors. The patient had good oral hygiene with no signs of gingivitis or caries found. There was no pain or other sign / symptom present in any teeth. The distribution of chalky, opaque white and brown spots on anterior teeth and her area of residence supported a diagnosis of moderate DF (Figure 1).



Figure 1. Preoperative photograph of Case 1 illustrating pitted and diffuse discoloration of the anterior teeth

Because the patient was young, wanted less invasive treatment, and the DF fell in the range of moderate, it was decided to perform microabrasion on the incisors, followed by 2% sodium fluoride and composite application on the labial surface.

Oral prophylaxis followed by rubber dam placement was done on the anterior teeth. A slurry mixture of 37% H_3PO_4 gel (Smart Etch, SafeEndo Pvt Ltd., Ahmedabad, India) and pumice powder (to achieve toothpaste like consistency) was coated on the labial surfaces of approximately 1mm thickness. The outer surface of the enamel was abraded with the use of a polishing cup (Prophy cups, Cotisen Ltd, China) at low speed using contra-angle handpiece (Figure 2). After 40 to 50 seconds of performing the abrasion, the paste was rinsed off and the enamel surface was re-evaluated.

This procedure was repeated four times to achieve desirable aesthetics.

After microabrasion procedure, a 2% sodium fluoride gel (Fluocal Gel, Septodont®, France) was applied for 4 minutes to prevent postoperative sensitivity. After one week on the next visit, restorative composite (shade A1, Te-Econom Plus, Ivoclar, India) was applied on the labial surface of the anterior to enhance the aesthetics. For shade selection of the composite, after choosing a shade from the guide, 1mm² of composite ball of that shade was cured on the affected tooth surface without bonding, to find the definitive shade match for the patient, which was then removed. The patient was pleased with the aesthetics achieved (Figure 3,4).

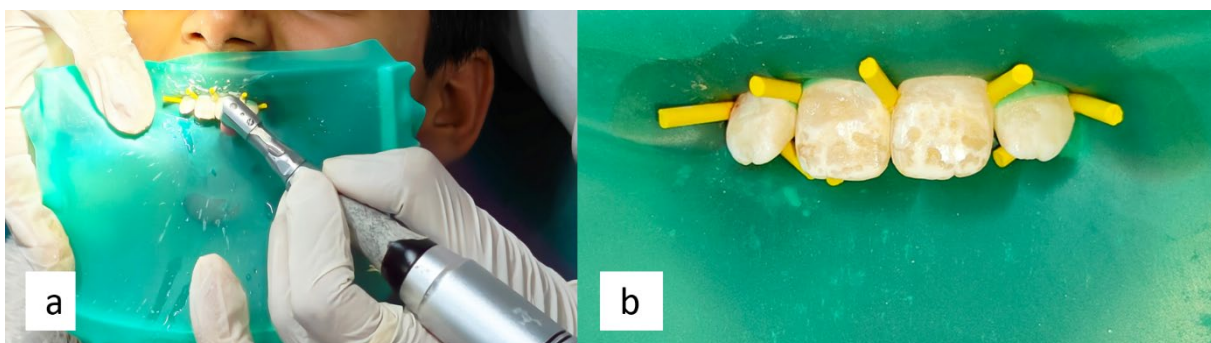


Figure 2. Intraoperative photographs. (a) Polishing of the enamel surface using a rubber cup with a latch-type handpiece; (b) Application of a rubber dam on the anterior teeth



Figure 3. Postoperative photographs of Case 1 following microabrasion and composite application



Figure 4. Comparative preoperative and postoperative photographs of Case 1, highlighting the changes in appearance

CASE 2

An 11-year-old male reported to the department with complaint of discolored anterior teeth and wanted aesthetic correction of the same. On recording the demographic data, it was noted that he lived in Unnao, a high fluoride belt region.¹¹ On examination, opaque white and brown discoloration (mottling) was observed on anterior teeth; pertaining to the clinical diagnosis of moderate fluorosis (Figure 5).

Minimally invasive treatment of microabrasion with 18% HCl and pumice slurry, followed by composite application was decided. After performing oral prophylaxis, rubber dam was placed on the anterior teeth and the patient was made to wear protective eye wear for safety from acid pumice slurry. One mm thickness of the slurry was coated on labial surface of teeth, and rubber cup attached on contra-angle handpiece was used for microabrasion (Figure 6).



Figure 5. Preoperative photographs of Case 2 showing brown and opaque white patchy discoloration of the anterior teeth

A total of three cycles of 30-40 seconds each were required to attain desirable esthetics, this was followed by application of 2% sodium fluoride for four minutes on the labial surface (Fluocal gel, Septodont®, France). After one-week, restorative composite was applied after shade matching to improve esthetics (shade A1, Te-Econom Plus, Ivoclar, India).

The shade matching was done as explained earlier for case 1. The patient was satisfied with the results and looked pleased with his look (Figure 7,8).

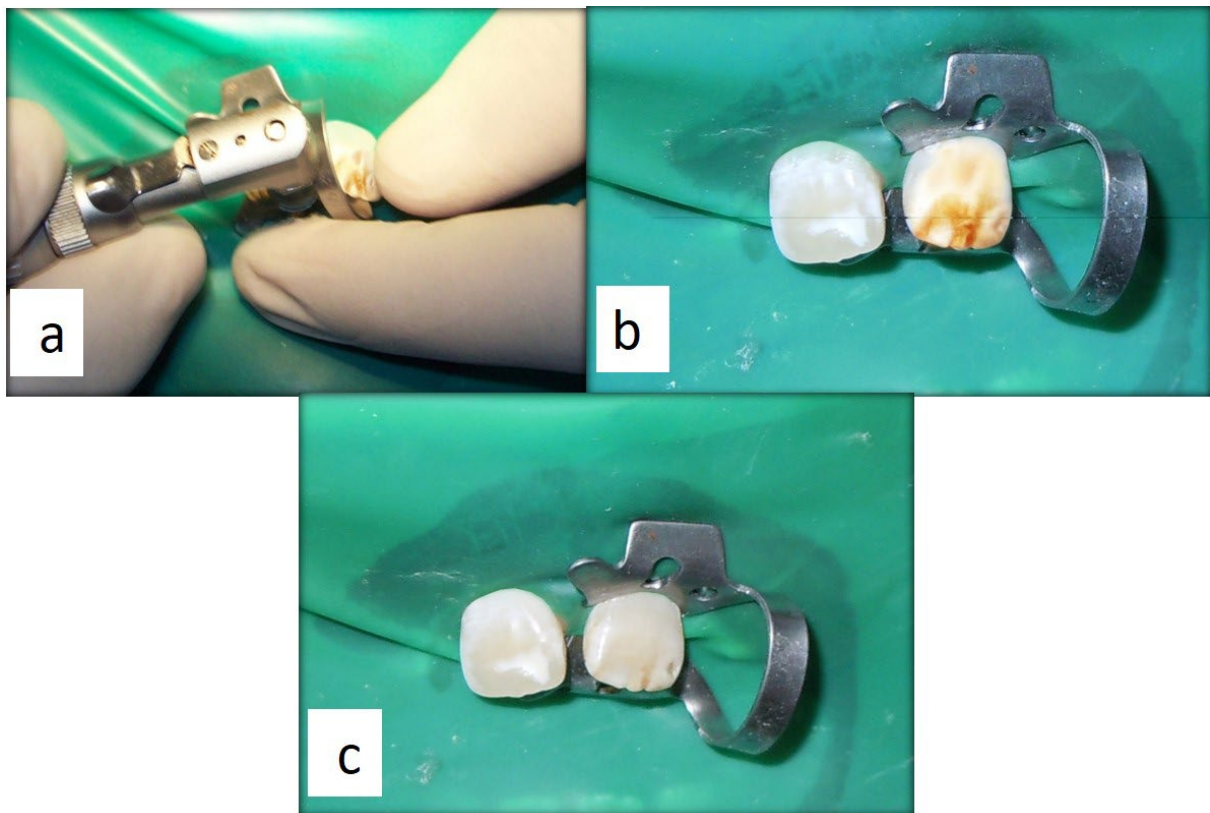


Figure 6. Intraoperative photographs. (a) Application of a rubber cup with a handpiece on the anterior teeth; (b) Post-microabrasion on tooth #11; (c) Post-microabrasion on teeth #11 and #21



Figure 7. Postoperative photographs of Case 2 following microabrasion and composite application



Figure 8. Comparative preoperative and postoperative photographs of Case 2, highlighting the changes in appearance

DISCUSSION

Dental fluorosis is a condition induced by chronically high fluoride intake during development of tooth. The degree of severity of dental fluorosis is determined by the amount of fluoride intake, their concentration and duration of exposure, degree of tooth bud development, genetic susceptibility, and environmental influences.¹³ It ranges from opaque white to brown to even blackish stains, causing serious aesthetic challenge in some cases.¹² Based on reports of 2017, a whopping 62 million people, including 6 million children were affected by fluorosis in India. Residence of both the above cases belonged to the state of Uttar Pradesh, of which the ground level water of Agra is 0.1 to 14.80 mg/L and that of

Unnao is 0.8–13.9 mg/L.^{11,12} The differential diagnosis of dental fluorosis includes molar incisal hypomineralization, enamel hypoplasia, white spot lesion.

A surge in demand for improved dental aesthetics has resulted in several scientific and technological advancements in numerous fields of dentistry. The minimally invasive microabrasion technique has demonstrated excellent results in the treatment of intrinsic stains, particularly those caused by fluorosis, due to its several advantages.¹⁰ Firstly, this is less invasive and conservative technique, requiring removal of only the outermost thin layer of enamel. Mild to moderate fluorotic lesions typically occur in the outer 80-100 μ m of enamel and microabrasion process removes the

first 25-200 µm of surface enamel, depending on acid concentration and application time.¹⁰ Furthermore, with utilizing adequate precautions, it does not cause postoperative discomfort or sensitivity, even when a young permanent tooth is treated. It is also a single-sitting procedure, being both permanent and cost-effective, leaving the enamel polished and lustrous.¹⁵ Keeping the benefits in mind, we chose the microabrasion technique followed by composite application to attain desired aesthetic.

In the present case, two different acidic compounds were incorporated. When comparing their efficacy, it was found that both acids produced desirable aesthetic results; however, the duration and cycles required to achieve the results were lesser in HCl-pumice slurry than in H₃PO₄-pumice slurry. This could be due to the more corrosive and potent character of HCl. Meireles et al.¹⁶ and Mendes et al.¹⁷ reported a larger and deeper region of demineralization with HCl than with H₃PO₄, which could explain why this molecule required less time and fewer applications in the current cases too. In both the present patients, 2% sodium fluoride gel was applied at the end of microabrasion procedure. Fluoride acts by formation of calcium fluoride which transforms hydroxyapatite into fluorapatite through the remineralization process.¹⁸

The clinical effectiveness of these two microabrasion compounds was compared for degree of stain removal and improvement in appearance and appearance improvement and stain removal degree.¹⁰ The results showed that HCl proved more clinical effectiveness than H₃PO₄, but the difference between the two was not statistically significant. Similarly, in a study conducted by Bassir and Bagheri¹⁹, they proposed using 18% HCL for cases of moderate to severe fluorosis to reduce the overall time and number of applications, hence minimizing enamel loss and

therefore yellowish staining. Therefore, microabrasion can be accomplished with both chemicals in an efficient manner; however, HCl required relatively less time and applications to complete the microabrasion treatment than H₃PO₄ pumice.

CONCLUSIONS

In the present report, both HCl and H₃PO₄ gave desirable and satisfactory results in aesthetic treatment of mild to moderate dental fluorosis; however, it was observed that HCl required lesser time and cycle in bringing out similar results as H₃PO₄ in comparable cases of fluorosis. Therefore, HCl can be opted to save time and carry out the procedures more efficiently. Nevertheless, excessive precautions should be maintained while handling HCl, especially with children due to its corrosive nature.

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Declarations

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Ethics Statement: *Procedures of treatment were clearly explained to the parents.*

Informed Consent: *Written consent was obtained from the parents prior to any treatment.*

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