

Minimally invasive approaches for esthetic enhancement in dental fluorosis: A case report

Muskan Jain¹, Rakesh Kumar Yadav², Promila Verma³, Rhythm Bhains³, Ramesh Bharti²

From ¹Junior Resident, ²Professor, ³Professor and Head, Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow, Uttar Pradesh, India

ABSTRACT

Dental fluorosis is a developmental enamel disorder characterized by hypomineralization and increased enamel porosity, which results in esthetic concerns that can impact a patient's quality of life. This case report highlights the importance of minimally invasive approaches for the management of moderate dental fluorosis in a 22-year-old patient, employing a combined treatment regimen comprising microabrasion and resin infiltration therapy. The patient exhibited symmetrical white-to-light-brown, with opaque areas affecting the maxillary front teeth. The treatment sequence started with microabrasion using 6.6% hydrochloric acid combined with silicon carbide microparticles, followed by resin infiltration with a low-viscosity methacrylate-based resin. The treatment produced immediate esthetic improvements by removing all brown stains and concealing white spots/opacities. These stable results persisted for 2 years without any adverse effects. This case demonstrates that the management of moderate dental fluorosis through microabrasion combined with resin infiltration can serve as an effective alternative to more invasive dental procedures.

Key words: Dental fluorosis, Esthetics, Microabrasion, Minimally invasive dentistry, Resin infiltration, Tooth discoloration

Dental fluorosis results from elevated fluoride exposure during tooth development and causes a developmental disturbance of dental enamel [1]. The condition produces hypomineralized, porous enamel that appears clinically as white spots or yellow-brown discolorations and, in more severe cases, as pitting or surface irregularities. Severity depends on the dose and duration of fluoride exposure during the developmental stage of the teeth and individual susceptibility. Globally, the incidence of dental fluorosis continues to increase due to multiple sources of fluoride, including fluoridated water, supplements, and certain foods and beverages [2]. In India, fluorosis remains endemic in states where groundwater fluoride levels exceed the recommended range of 0.7–1.2 ppm, resulting in significant esthetic concerns, particularly when anterior teeth are affected. Such discolorations may lead to psychological distress and reduced quality of life [3]. According to recent World Health Organization (WHO) data, excessive fluoride exposure can lead to dental fluorosis, with mild forms affecting an estimated 12–33% of populations exposed to high-fluoride water sources, underscoring the public health importance of this condition [4].

Traditional management approaches, including crowns, veneers, and composite restorations, often require substantial tooth reduction. Modern dentistry increasingly prioritizes minimally invasive techniques that preserve enamel while improving esthetics. Evidence supports microabrasion, bleaching, and resin infiltration as effective conservative options for treating dental fluorosis-related enamel changes [5].

CASE PRESENTATION

A 22-year-old woman presented to the Department of Conservative Dentistry and Endodontics with concerns regarding the discoloration of her maxillary anterior teeth, which adversely affected her smile and confidence. She reported long-term exposure to elevated fluoride levels in drinking water during childhood and noted similar discolorations among several relatives, suggesting an environmental etiology.

Clinical examination revealed symmetrical white to light brown opaque areas predominantly affecting the middle and incisal thirds of the maxillary anterior teeth (Fig. 1a). These diffuse opacities, accompanied by yellow-brown staining, were characteristic of moderate dental fluorosis based on Dean's Fluorosis

Access this article online

Received - 19 November 2025
Initial Review - 12 December 2025
Accepted - 30 December 2025

Quick Response code



DOI: 10.32677/ijcr.v12i1.7968

Correspondence to: Rakesh Kumar Yadav, Department of Conservative Dentistry and Endodontics, Faculty of Dental Sciences, King George Medical University, Lucknow, India. E-mail: rakeshanita10@yahoo.in

© 2026 Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC-ND 4.0).

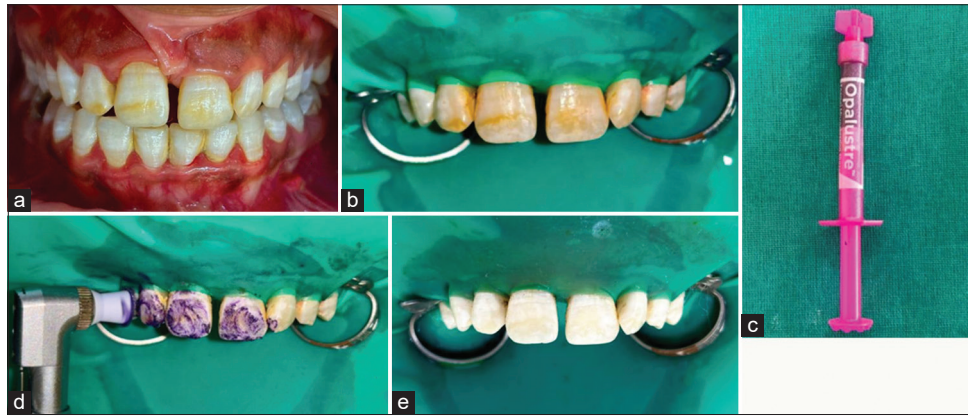


Figure 1: (a) Preoperative view showing dental fluorosis, (b) rubber dam isolation before treatment, (c) microabrasion with Opalustre (6.6% HCL and silicon carbide), (d) microabrasion with a rubber cup, and (e) immediate post-microabrasion

Index [3]. Importantly, no pitting or structural surface defects were detected, indicating preservation of overall enamel integrity. The patient's medical history was non-contributory, and she had not previously undergone any dental intervention for her discoloration. Given the esthetic concerns and intact enamel, a minimally invasive treatment approach was considered most appropriate.

Clinical examination was the primary method of evaluation. Under proper illumination, digital photographs documented the severity of discoloration and compressed air enhanced visualization of enamel opacities by dehydrating the tooth surface. Vitality assessment using cold and electric pulp tests confirmed the pulp's vitality. Fluorosis severity was determined using Dean's Fluorosis Index [3], indicating moderate fluorosis with diffuse white opacities and brown stains but no surface pitting. The differential diagnosis included white spot lesions, developmental enamel hypoplasia, and molar-incisor hypomineralization; however, the patient's clinical presentation and history were most consistent with dental fluorosis [6].

The treatment involved a combination of microabrasion and resin infiltration to preserve as much tooth structure as possible while addressing the patient's cosmetic concerns. The procedure was carried out in two appointments. During the first appointment, treatment began with the application of a fluoride-free polishing paste to remove superficial deposits through thorough prophylaxis. A rubber dam was then placed to protect soft tissues, maintain a dry field, and to prevent accidental ingestion of materials during the procedure (Fig. 1b). Microabrasion was performed using Opalustre (Ultradent Products Inc., South Jordan, UT, USA), a material containing 6.6% hydrochloric acid and silicon carbide microparticles [7] (Fig. 1c). A rubber cup on a slow-speed handpiece was used to apply gentle pressure for 5–10 s per tooth (Fig. 1d), which was repeated for three cycles, with a total contact time of <1 min. After each cycle, the surface was thoroughly rinsed to remove abrasive residue. This step produced a noticeable reduction in brown discolorations; however, white opacities persisted in several regions [7] (Fig. 1e).

To address these deeper fluorotic lesions, Icon (DMG, Hamburg, Germany) resin infiltration was selected as the second phase of treatment (Fig. 2a). During the second appointment, Icon-Etch (15% hydrochloric acid gel) was applied for two minutes to remove the hypermineralized surface layer and expose the porous subsurface enamel (Fig. 2b). Gentle agitation enhanced etching efficiency and improved penetration. After a 30-s water rinse and air-drying, Icon-Dry (99% ethanol) was applied for 30 seconds to desiccate the enamel and preview the anticipated masking effect [8] (Fig. 2c). Next, Icon-Infiltrant, a low-viscosity methacrylate resin, was applied for 3 min to ensure deep penetration into the lesion body (Fig. 2d). Excess material was removed, and each tooth was light-cured for 40 s. The procedure concluded with the removal of the rubber dam and final polishing with a fluoride-enriched prophylactic paste to enhance surface smoothness [8] (Fig. 2e).

Immediate post-operative evaluation demonstrated a significant improvement in esthetics, with complete elimination of brown stains and a noticeable reduction in white opacities (Figs. 3a and b). At 2-year follow-up, the enhanced esthetic appearance remained stable (Fig. 3c). The patient reported no sensitivity and was advised to attend regular check-ups and to follow short-term dietary precautions to protect the newly infiltrated enamel.

DISCUSSION

The treatment of dental fluorosis poses a significant challenge in esthetic dentistry because it requires effective removal or masking of discoloration while preserving healthy tooth structure. This case highlights the successful use of minimally invasive cosmetic procedures, specifically microabrasion combined with resin infiltration, for managing moderate fluorosis. Existing literature supports the efficacy of this conservative approach. Wang *et al.* reported stable esthetic outcomes at 12 months following this combined technique. At the same time, Zotti *et al.* confirmed the long-term masking ability of resin infiltration for fluorotic lesions. These published findings correlate well with the present case, which

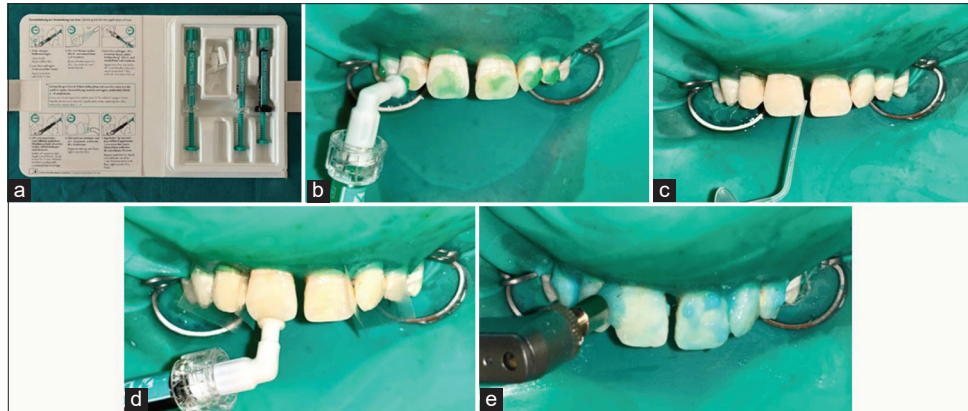


Figure 2: (a) ICON DMG resin infiltration kit. (b) application of Icon-Etch (15% HCL) for 120 s, (c) dehydration with Icon-Dry 999% ethanol for 30 s, (d) application of Icon-Infiltrant for 3 min, and (e) prophylactic polishing with rubber cups

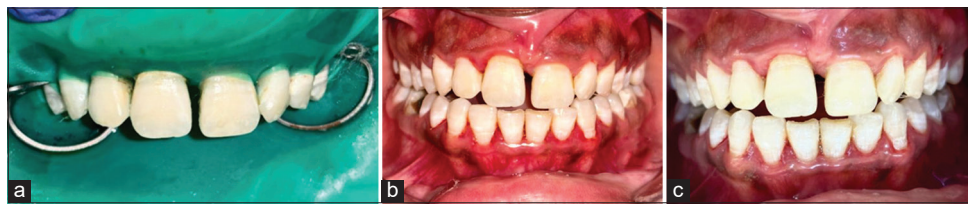


Figure 3: (a) Post-operative view showing marked esthetic improvement, (b) post-operative smile with enhanced natural esthetics, and (c) 2-year follow-up picture

demonstrated substantial esthetic improvement at the 3-month evaluation [8,9].

Fluorosis-related enamel opacities are among the most challenging enamel defects to correct because their depth and distribution vary widely. Minimally invasive interventions, such as microabrasion and resin infiltration, are particularly advantageous in managing non-pitted fluorosis, as they preserve the maximum amount of natural tooth structure while improving esthetics [10]. Resin infiltration enhances esthetics by modifying the optical properties of hypomineralized enamel and offers a conservative alternative to more invasive restorative procedures. In contrast, conventional treatments such as full-coverage crowns, porcelain veneers, or direct composite restorations often require substantial removal of sound enamel [11]. For example, full-coverage crowns typically require 1.5–2.0 mm of circumferential reduction, which can result in the loss of up to 75% of coronal enamel. Similarly, porcelain veneers generally require 0.5–0.7 mm of facial surface reduction, which may compromise enamel integrity over time [12].

Microabrasion, by comparison, removes only 10–200 μm of enamel, making it a significantly more conservative option. This technique employs a combination of acid erosion and mechanical abrasion to eliminate superficial intrinsic and extrinsic stains. When followed by resin infiltration, deeper subsurface porosities can be effectively masked. Resin infiltration replaces air or water within porous enamel with a low-viscosity resin whose refractive index ($\text{RI} \approx 1.52$) closely matches that of natural enamel ($\text{RI} \approx 1.62$), thereby reducing the optical contrast responsible for white spot visibility [13,14].

This conservative two-step approach provides multiple advantages, including reduced chair time,

enhanced patient comfort, cost-effectiveness, and preservation of future restorative options. Despite these benefits, limitations must be acknowledged. Cases of severe fluorosis with deep pitting or significant enamel loss may require more extensive restorative interventions. In addition, although short- and medium-term results are encouraging, the long-term stability of resin infiltration beyond 3 to 4 years remains an area requiring further investigation [15].

Given the increasing prevalence of fluorosis in high-fluoride regions, minimally invasive strategies such as microabrasion combined with resin infiltration represent a practical, biologically conservative, and esthetically effective approach for improving the appearance of affected teeth.

CONCLUSION

This case demonstrates that minimally invasive techniques, specifically microabrasion combined with resin infiltration, provide an effective and conservative solution for managing moderate dental fluorosis. The treatment achieved significant and stable esthetic improvement while preserving natural tooth structure and ensuring patient comfort. Given the growing prevalence of fluorosis in high-fluoride regions, these approaches offer a valuable alternative to more invasive restorative procedures. They should be considered as first-line management when enamel integrity is largely preserved.

REFERENCES

- Gu LS, Wei X, Ling JQ. Aetiology, diagnosis, prevention and treatment of dental fluorosis. *Zhonghua Kou Qiang Yi Xue Za Zhi* 2020;55:296-301.
- Morris AJ, Connor RO, Holmes R, Landes D, Shah K, Tandy A,

- et al.* Dental fluorosis. *Br Dent J* 2022;232:492.
3. Hung M, Hon ES, Mohajeri A, Moparthi H, Vu T, Jeon J, *et al.* A national study exploring the association between fluoride levels and dental fluorosis. *JAMA Netw Open* 2023;6:e2318406.
 4. Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First and Second Addenda. Available from: <https://www.who.int/publications/i/item/9789240045064> [Last accessed on 2025 Dec 11].
 5. Torres PJ, Phan HT, Bojorquez AK, Garcia-Godoy F, Pinzon LM. Minimally invasive techniques used for caries management in dentistry. A review. *J Clin Pediatr Dent* 2021;45:224-32.
 6. Suckling GW. Developmental defects of enamel--historical and present-day perspectives of their pathogenesis. *Adv Dent Res* 1989;3:87-94.
 7. Oliveira A, Felinto LT, Francisconi-Dos-Rios LF, Moi GP, Nahsan FP. Dental bleaching, microabrasion, and resin infiltration: Case report of minimally invasive treatment of enamel hypoplasia. *Int J Prosthodont* 2020;33:105-10.
 8. Wang Q, Meng Q, Meng J. Minimally invasive esthetic management of dental fluorosis: A case report. *J Int Med Res* 2020;48:300060520967538.
 9. Zotti F, Albertini L, Tomizioli N, Capocasale G, Albanese M. Resin infiltration in dental fluorosis treatment-1-year follow-up. *Medicina (Kaunas)* 2020;57:22.
 10. Gu gnani N, Pandit IK, Gupta M, Gu gnani S, Soni S, Goyal V. Comparative evaluation of esthetic changes in nonpitted fluorosis stains when treated with resin infiltration, in-office bleaching, and combination therapies. *J Esthet Restor Dent* 2017;29:317-24.
 11. Attal JP, Atlan A, Denis M, Vennat E, Tirlet G. White spots on enamel: Treatment protocol by superficial or deep infiltration (part 2). *Int Orthod* 2014;12:1-31.
 12. Khoroushi M, Kachuie M. Prevention and treatment of white spot lesions in orthodontic patients. *Contemp Clin Dent* 2017;8:11-9.
 13. Auschill TM, Schmidt KE, Arweiler NB. Resin infiltration for aesthetic improvement of mild to moderate fluorosis: A six-month follow-up case report. *Oral Health Prev Dent* 2015;13:317-22.
 14. Cocco AR, Lund RG, Torre E, Martos J. Treatment of fluorosis spots using a resin infiltration technique: 14-month follow-up. *Oper Dent* 2016;41:357-62.
 15. Gençer MD, Kirzioğlu Z. A comparison of the effectiveness of resin infiltration and microabrasion treatments applied to developmental enamel defects in colour masking. *Dent Mater J* 2019;38:295-302.

Funding: Nil; Conflicts of interest: Nil.

How to cite this article: Jain M, Yadav RK, Verma P, Bhains R, Bharti R. Minimally invasive approaches for esthetic enhancement in dental fluorosis: A case report. *Indian J Case Reports*. 2026; 12(1):65-68.