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Case Report

Conservative combined approach for esthetic management of brown fluorosis lesions—two case reports

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Abstract

Dental fluorosis often causes white or brown discolorations on anterior teeth, presenting an esthetic concern. This report describes a conservative treatment combining dental bleaching and resin infiltration for moderate brown fluorosis lesions. Two patients underwent light-activated bleaching with high-concentration hydrogen peroxide, followed by resin infiltration (Icon Infiltrant, DMG, Germany) after multiple etching cycles. Bleaching alone produced partial improvement, while subsequent resin infiltration achieved a uniform color and stable esthetic results. Both patients reported high satisfaction at the six-month follow-up. The combined approach of bleaching and resin infiltration is a minimally invasive and effective option for improving the appearance of brown fluorosis lesions.

Keywords

bleaching, brown fluorosis lesions, resin infiltration

Introduction

Dental fluorosis arises from excessive systemic fluoride exposure during enamel formation, leading to hypomineralization and enamel opacities that vary in severity. Brown fluorosis represents moderate to severe forms and is particularly noticeable on anterior teeth, affecting patients' esthetic perception and psychosocial well-being.[1,2]

Treatment options range from conservative techniques such as microabrasion, bleaching, and resin infiltration to invasive restorative interventions including macroabrasion, composite restorations, and ceramic veneers.[3,4] Minimally invasive approaches are preferred when possible, aiming to preserve healthy enamel while improving esthetics.

While effective for superficial discoloration, bleaching alone may not fully mask deeper brown lesions.[5,6] Resin infiltration, which was originally developed to arrest non-cavitated carious lesions, modifies the enamel refractive index, reducing the visual appearance of hypomineralization.[7,8] Combining bleaching and resin infiltration provides a synergistic effect: bleaching reduces superficial chromophores, and resin infiltration masks residual subsurface discoloration. This approach aligns with the principles of minimally invasive dentistry and has demonstrated promising esthetic outcomes.[4,9]

Objective

To present two cases of moderate brown fluorosis (TFI=4) lesions treated with a conservative combined approach, with a focus on procedural details and clinical results.

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Case reports

Case 1

A 26-year-old male patient presented with moderate brown fluorosis (TFI=4) affecting the maxillary anterior teeth, accompanied by generalized white opacities ***(Fig. 1a)****. The patient reported concern regarding esthetic appearance and requested minimally invasive treatment. Medical history was not relevant, with fluoride exposure likely from drinking water during childhood.*

Treatment protocol:

1. Professional cleaning: ultrasonic scaling, removal of external stains via air abrasion, and polishing.
2. Bleaching: 40% hydrogen peroxide gel (Power Whitening 40%, WHITEsmile GmbH, Birkenau, Germany) applied in three 15-minute cycles with light activation (Bluedent 12BL LED whitening lamp, BG Light Ltd., Plovdiv, Bulgaria). A second session targeted residual brown spots with a single 15-minute application ***(Fig. 1b–e)****. Post-bleaching, brown stains acquired a yellowish hue* ***(Fig. 1f)****.*
3. Resin infiltration: One month post-bleaching, Icon Infiltrant (DMG, Hamburg, Germany) was applied from the first right upper premolar to the first left upper premolar. Triple etching with 15% HCl was performed, with ethanol testing and transillumination to assess enamel readiness for infiltration ***(Fig. 1g–k)****. Infiltrant was applied for 3 minutes (light-cured 40 s), followed by a second 1-minute application and final polishing* ***(Fig. 1l, m)****.*

Outcome: Visual assessment indicated improved optical integration of the brown lesions ***(Fig. 1n)****. The patient reported high satisfaction. Six-month follow-up demonstrated stable esthetic results* ***(Fig. 1o)****.*

Figure 1. Clinical case 1. **a)** initial situation – moderate fluorosis with brown spots; **b)** first procedure of bleaching; **c)** after first bleaching; **d)** second bleaching; **e)** after second bleaching; **f)** one month after bleaching; **g)** etching with Icon Etch for 2 min; **h)** after etching; **i)** transillumination for checking readiness for infiltration; **j)** second etching for 2 min; **k)** transillumination; etching and transillumination were repeated one more time; **l)** resin infiltration with Icon Infiltrant for 3 min; **m)** lightcuring for 40 s.; reapplication of Icon Infiltrant for 1 min followed; **n)** final result; **o)** six-month follow up.

Case 2

A 23-year-old male patient presented with moderate brown fluorosis (TFI=4) on the maxillary central incisors, along with generalized white opacities ***(Fig. 2a)****. He expressed concern over anterior teeth discoloration. The patient had no significant medical history; fluoride exposure likely from toothpaste and water during childhood.*

Treatment protocol included:

1. Bleaching: In-office application of 29% hydrogen peroxide gel (BlancOne ULTRA, IDS S.p.A., Savona, Italy) for three 8-minute cycles with light activation with the Bluedent 12BL LED whitening lamp (BG Light Ltd., Plovdiv, Bulgaria) ***(Fig. 2b)****. Brown spots turned yellowish post-bleaching* ***(Fig. 2c)****.*
2. Resin infiltration: One month later, the same protocol as Case 1 was applied (triple etching, ethanol test, dual resin applications, light curing, polishing) on teeth from first premolar to first premolar.

Outcome: Visual improvement of brown lesions was achieved; the patient reported high satisfaction ***(Fig. 2d)****. A six-month follow-up showed stable esthetic results* ***(Fig. 2e)****.*

Previous studies have shown that in-office bleaching effectively reduces the contrast of brown fluorosis lesions but rarely achieves complete masking when the discoloration extends into the subsurface enamel.[2,7] Wang et al. reported partial esthetic improvement in moderate fluorosis after hydrogen peroxide bleaching, similar to our observations where brown spots acquired a yellowish hue.[2] Paris and Meyer-Lueckel and Meyer-Lueckel et al. demonstrated that low-viscosity resin infiltration can penetrate hypomineralized enamel, reduce the visual appearance of white and brown opacities, and stabilize lesions structurally.[8,9] However, infiltration without prior bleaching may not sufficiently lighten the chromogenic content, limiting the final esthetic outcome. Nicholas et al. reported that the sequential use of bleaching followed by resin infiltration improves both surface brightness and optical integration of brown fluorosis lesions, confirming the synergistic effect observed in our cases.[4] Similarly, Barakat et al. highlighted that combining minimally invasive techniques enhances patient satisfaction compared with single interventions.[3]

In the two cases presented, two different bleaching systems with different concentrations and activation times were used, allowing individualization of care based on patient-specific factors, fluorosis severity, and clinical handling preferences. BlancOne ULTRA 29% (IDS S.p.A., Italy) employs a short-contact, photo-activated protocol intended to minimize sensitivity and maximize patient comfort while still achieving effective chromophore reduction. In contrast, Power Whitening 40% (WHITEsmile GmbH, Germany) uses higher peroxide concentrations and longer intervals, making it more suitable for deeper discolorations.

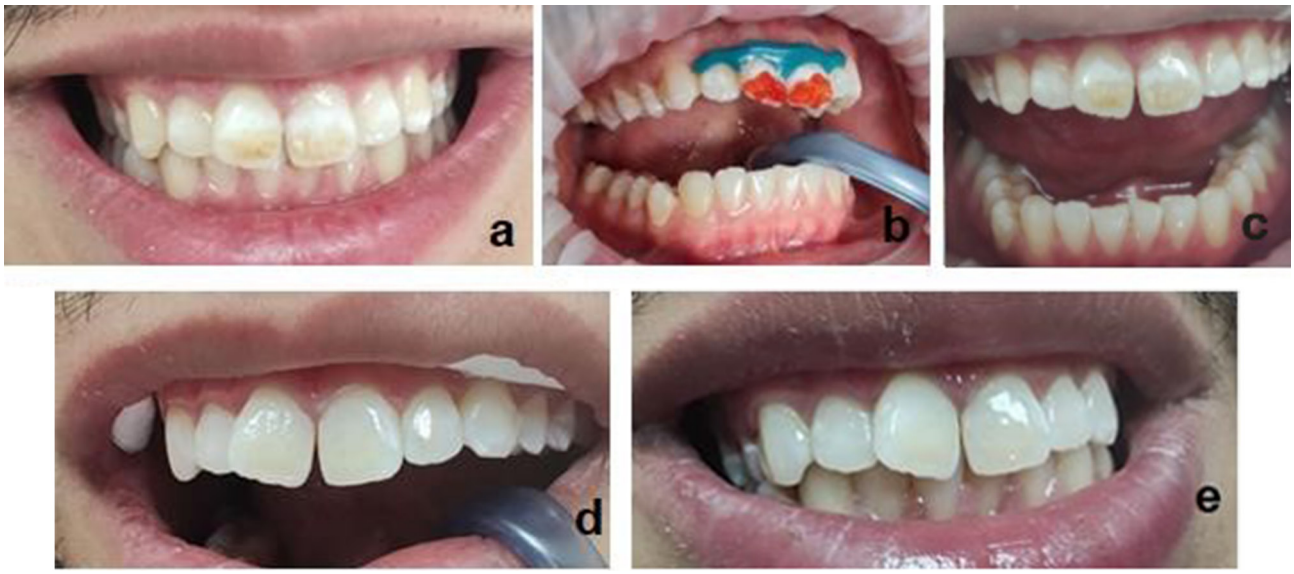

Figure 2. Clinical case 2. **a)** initial situation - moderate fluorosis with brown fluorosis spots; **b)** bleaching with BlancOne Ultra 3 times × 8 min; **c)** after bleaching; **d)** immediately after resin infiltration; **e)** six months after treatment.

Discussion

The management of brown fluorosis lesions remains a clinical challenge due to their depth, irregularity, and esthetic impact. In the two cases presented, a non-invasive treatment strategy combining in-office bleaching and resin infiltration proved effective in reducing the visibility of brown moderate fluorosis stains and enhancing the overall tooth appearance.

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Prior to resin application, proper lesion surface etching was essential. Although the manufacturer suggests a single etching step, clinical evidence supports the use of two to three etching cycles, particularly in lesions with hypermineralized superficial enamel, which often inhibits resin penetration in fluorosed teeth.[8,9]

To assess the effectiveness of each etching cycle, transillumination was employed during the ethanol application to visualize surface porosity and lesion depth after etching.[10,11]

The ethanol drying test served as a practical and clinically relevant method to preview the optical blending effect of the infiltrant. Oxygen radicals from bleaching inhibit resin polymerization if infiltration is performed immediately after bleaching. That is why, in the presented cases, resin infiltration was postponed for a month after the bleaching procedure.[5]

No postoperative hypersensitivity or adverse effects were observed, and patients reported high satisfaction levels, which persisted at the six-month review.

Despite the benefits, certain limitations must be acknowledged. The long-term color stability of resin-infiltrated fluorosis lesions remains an area of active investigation. Some reports have noted slight discoloration over time, potentially due to resin aging or extrinsic staining.[12] Additionally, case selection is critical; deeply pigmented or extensively hypoplastic lesions may still require alternative or adjunctive restorative treatments. Future randomized clinical trials are needed to assess long-term efficacy, patient satisfaction, and optimal treatment protocols.

Conclusion

The synergistic application of bleaching followed by resin infiltration offers a conservative and effective approach for managing moderate brown fluorosis lesions. This treatment sequence not only improves esthetics but also aligns with the principles of minimally invasive dentistry.

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Additional information

Ethical statements

- The authors declared that no clinical trials were used in the present study.
- The authors declared that no experiments on humans or human tissues were performed for the present study.
- Informed consent was obtained from both patients for treatment, clinical photography, and publication of the case details and clinical images.
- The authors declared that no experiments on animals were performed for the present study.
- The authors declared that no commercially available immortalized human and animal cell lines were used in the present study.

Conflict of interest

The authors have declared that no competing interests exist.

Artificial Intelligence (AI) use

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Data availability

All of the data that support the findings of this study are available in the main text.