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Aesthetic Rehabilitation of Maxillary Anterior Teeth Affected by Moderate-to-Severe Dental Fluorosis Using Ceramic Veneers: A Clinical Case Report

Dr. Sharon Sara Thomas, Post Graduate Resident
Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow, Uttar Pradesh, India.

Dr. Vijay Kumar Shakya, MDS, Professor
Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow, Uttar Pradesh, India

Dr. Promila Verma, MDS, Professor
Head of Department, Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow, Uttar Pradesh, India.

Dr. Rakesh Kumar Yadav, MDS, Professor
Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow, Uttar Pradesh, India.

Dr Shailja Singh, MDS, Assistant Professor
Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow, Uttar Pradesh, India.

Abstract

Management of moderate-to-severe dental fluorosis complicated by enamel hypomineralization and intrinsic staining presents a significant esthetic challenge. Conventional conservative therapies, such as microabrasion and bleaching, are often insufficient to mask deep discoloration and surface defects. This case report describes the clinical management of a young adult patient presenting with moderate to severe endemic fluorosis on the maxillary anterior teeth. Following a comprehensive diagnostic evaluation and a direct chairside mock-up, minimal-preparation porcelain laminate veneers were executed from the maxillary right canine to the left canine (teeth #13 to #23). The superficial hypermineralized fluorotic enamel was removed to ensure reliable adhesive bonding. A digital intraoral scanner was utilized for the definitive impression. CAD/CAM-fabricated lithium disilicate restorations successfully masked the underlying intrinsic brownish discoloration while preserving maximal sound tooth structure, achieving a harmonious, functional, and highly esthetic outcome.

Keywords: Dental fluorosis; Lithium disilicate; Porcelain laminate veneers; Computer-aided design; Intraoral scanner; Esthetics, Dental

Introduction

Dental fluorosis is a developmental hypomineralization defect of enamel caused by chronic systemic ingestion of excess fluoride during amelogenesis. Clinically, it presents with a wide range of defects ranging from mild white opacities to severe brownish discoloration, surface pitting, and structural breakdown of the outer enamel surface. [1], [2]

In moderate-to-severe cases, conservative modalities such as microabrasion and vital bleaching frequently fail to mask deep-seated intrinsic discoloration and structural alterations in human dental enamel [3] While full-coverage crowns provide excellent masking capabilities, they require the aggressive reduction of sound tooth structure, posing biological risks to pulp vitality, particularly in young patients.[4] Porcelain laminate veneers (PLVs) offer a conservative, biologically sound alternative that achieves high-level esthetics with minimal hard-tissue removal.[5]

This case report details the esthetic rehabilitation of a patient with moderate-to-severe dental fluorosis and intermediate spacing utilizing a digital definitive impression and maxillary canine-to-canine lithium disilicate ceramic veneers.

Case Report A young 17-year patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of an unesthetic smile due to severe brownish discoloration of the upper front teeth. Her medical history was unremarkable. She gives a history of relying on drinking water from groundwater through borewells during her childhood days.

Clinical intraoral inspection revealed mottled, opaque enamel with prominent horizontal yellow-brown bands and superficial enamel breakdown affecting the labial surfaces and incisal edges of the maxillary anterior teeth, specifically #13, #12, #11, #21, #22, and #23. A black contrastor was used during photographic documentation to clearly visualize the extent of the incisal translucency loss and labial surface irregularities. The marginal gingiva was healthy with an adequate zone of keratinized tissue. Occlusal evaluation demonstrated a Class I canine and molar relationship with stable anterior guidance and normal overjet and overbite. The condition was diagnosed as moderate-to-severe dental fluorosis (Thylstrup-Fejerskov Index Score 5–6) for tooth 11 and 21, [Thylstrup-Fejerskov Index Score3-4] for teeth 12,13,22 and 23. There was also a 2 mm gap between the central and lateral incisors. Treatment was planned to place veneers from 13 to 23 for the purpose of correcting esthetics and spacing. Baseline shade matching was performed using a standard shade guide to map the underlying discoloration prior to preparation.

Preliminary impressions were made using an irreversible hydrocolloid (Zhermack Tropicalgin, Zhermack SpA, Badia Polesine, Italy) to fabricate diagnostic study casts. A diagnostic wax-up was performed from tooth #13 to #23. A silicone putty matrix (Aquasil Soft Putty, Dentsply Sirona, Charlotte, NC, USA) was fabricated over the wax-up to facilitate a direct chairside mock-up using a bis-acryl composite resin (Protemp 4, 3M ESPE, St. Paul, MN, USA).

Tooth preparation was performed through the mock-up using depth-limiting diamond burs, with orientation depth grooves marked directly on the labial surfaces to ensure minimal and controlled enamel reduction. Facial reduction was maintained between 0.3 mm and 0.5 mm, finishing in an equigingival chamfer margin across the anterior segment. An incisal butt-joint reduction of 1.5 mm was prepared to ensure adequate ceramic bulk for strength and optical properties.

A definitive digital impression of the prepared teeth and the opposing arch was captured using an intraoral scanner (TRIOS 4, 3Shape, Copenhagen, Denmark), and a virtual interocclusal record was taken. Provisional restorations were fabricated using the initial silicone matrix and spot-etched into place.

The definitive restorations were designed using computer-aided design (CAD) software and milled from high-translucency lithium disilicate glass-ceramic blocks (IPS e.max CAD, Ivoclar Vivadent, Schaan, Liechtenstein).

During the cementation appointment, the provisional veneers were removed, and the preparations were cleaned. The intaglio surfaces of the lithium disilicate veneers were etched with 5% hydrofluoric acid (IPS Ceramic Etching Gel, Ivoclar Vivadent) for 20 seconds, rinsed thoroughly, air-dried, and treated with a silane coupling agent (Monobond Plus, Ivoclar Vivadent) for 60 seconds.

The prepared teeth were isolated, etched with 37% phosphoric acid (Total Etch, Ivoclar Vivadent) for 15 seconds, rinsed, and gently dried. A universal dental adhesive (Tetric N-Bond Universal, Ivoclar Vivadent) was applied and air-thinned without light-curing. A light-cured resin luting composite (Variolink Esthetic LC, Ivoclar Vivadent) was applied to the internal surface of each veneer. The restorations were seated sequentially, excess cement was carefully removed, and light polymerization was performed for 40 seconds per surface. The margins were finished and polished using fine diamond points and a ceramic polishing system (OptraGloss, Ivoclar Vivadent). The final restorations exhibited excellent marginal adaptation, successfully masked the underlying discoloration, and provided a highly esthetic outcome.

Discussion

The rehabilitation of fluorosed anterior teeth requires a careful balance between masking intense underlying

discoloration and preserving tooth structure. [6] While bleaching and microabrasion are effective for mild lesions, moderate-to-severe fluorosis involves deeper subsurface hypomineralization that renders conservative chemical treatments unpredictable and often temporary. [7]

Porcelain laminate veneers offer superior longevity, marginal integrity, biocompatibility, and optical properties compared to direct composite resin restorations. [8] Integrating a digital workflow for the definitive impression via intraoral scanning and CAD/CAM milling enhances patient comfort, reduces dimensional inaccuracies associated with traditional impression materials, and streamlines the design of the restorations. [9] Lithium disilicate glass-ceramic was selected for this case due to its high flexural strength (400–500 MPa) and its exceptional balance between opacity—required to mask the dark fluorotic stains—and natural translucency. [10]

The masking capability of lithium disilicate restorations is influenced by several factors, including ceramic thickness, material translucency, underlying substrate color, and the shade of the resin cement. In fluorosed teeth with prominent brown discoloration, these variables must be considered during restorative planning to avoid inadequate masking or an excessively opaque final appearance. [10], [11]

A critical consideration when bonding to fluorotic enamel is the altered morphological structure, which typically includes a highly hypermineralized, acid-resistant outer surface layer overlying hypomineralized subsurface enamel. [13] The minimal preparation protocol employed in this case removed the superficial hypermineralized enamel layer. This step is essential as it exposes the morphologically normal subsurface enamel, ensuring a predictable acid-etch pattern and facilitating a high micro-mechanical bond strength. Extending the preparations comprehensively from the right canine to the left canine ensured harmonious color symmetry, proper width-to-height proportions, and an ideal smile arc.

Clinical Significance and Limitations

This case demonstrates the clinical application of a minimally invasive ceramic veneer approach for managing moderate-to-severe dental fluorosis and spacing involving the maxillary anterior segment. The combination of diagnostic planning, controlled tooth preparation, lithium disilicate ceramic restorations, and digital impression acquisition provided a structured approach to addressing intrinsic discoloration while limiting removal of sound tooth structure.

Added to that, the findings should be interpreted within the limitations of a single-patient clinical report. There was no comparative treatment group, and the clinical contribution of individual components of the treatment protocol cannot be isolated. Nevertheless, the available follow-up was limited to 6 months, which is insufficient to establish long-term veneer survival, sustained marginal integrity, or long-term periodontal and pulpal outcomes.

Additional clinical follow-up is necessary to evaluate the durability of the restorations and the maintenance of the esthetic outcome over time.

Conclusions

Minimally prepared lithium disilicate ceramic veneers may provide an effective esthetic rehabilitation option for carefully selected patients with moderate-to-severe dental fluorosis when bleaching and microabrasion alone are unlikely to achieve adequate masking and correction of space in well aligned arch. A treatment approach incorporating diagnostic wax-up, chairside mock-up, controlled enamel reduction, appropriate adhesive procedures, and digital restorative fabrication can facilitate conservative rehabilitation of affected anterior teeth. But, long-term clinical evaluation is necessary before conclusions regarding the durability and longevity of the restorations can be established.

Declarations

Conflict of Interest No potential conflict of interest relevant to this article was reported.

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Author Contributions

Dr. Sharon Sara Thomas: Conceptualization, patient management, data collection, literature review, and writing—original draft preparation.

Dr. Vijay Kumar Shakya: Supervision, manuscript review and editing; approval of the manuscript.

Dr. Promila Verma: Overall supervision and final approval of the manuscript.

Dr. Rakesh Kumar Yadav: Clinical supervision and critical revision of the manuscript.

Dr. Shailja Singh: Manuscript review and editing : critical revision of the manuscript.

Data Availability Statement Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Patient Consent Statement Written informed consent was obtained from the patient for the publication of this case report and accompanying clinical images.

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Figure 1. Preoperative intraoral photographs showing severe dental fluorosis. (A) Frontal view in maximum intercuspation. (B) Frontal view using a contrastor to highlight incisal edge irregularities.(C) Frontal view utilizing a black contrastor to highlight superficial enamel breakdown. (D) Lateral profile view with contrastor.





Figure 2. Clinical tooth preparation phase. (A) Depth orientation grooves established on the labial surfaces. (B) Final minimal preparation from maxillary right canine to left canine showing equigingival margins. (C) Frontal view of prepared teeth and shade selection





Figure 3: [A]Digital Impression [B] Laboratory evaluation of CAD/CAM-fabricated lithium disilicate ceramic veneers (teeth #13 to #23) seated on a 3D-printed resin working model, demonstrating passive fit, marginal adaptation, and interproximal contact relationships prior to clinical try-in.



Figure 4. Postoperative photographs. (A) Final lithium disilicate ceramic veneers in occlusion, showing complete masking of fluorotic stains. (B) Immediate postoperative frontal view