



RESCULPTING RADIANCE: A DIGITAL JOURNEY FROM FLUOROSIS TO FLAWLESS: A CASE REPORT

Prosthodontics

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ABSTRACT

Dental fluorosis is a developmental enamel defect caused by excessive fluoride intake during amelogenesis, resulting in intrinsic discoloration and esthetic concerns. Management becomes more challenging when associated with anterior spacing. This case report describes the esthetic rehabilitation of a 31-year-old female patient presenting with moderate fluorosis and maxillary anterior diastema. A digitally guided treatment plan using Digital Smile Design was carried out, followed by conservative tooth preparation and rehabilitation with high-translucency zirconia veneers. A complete digital workflow was used for smile analysis, prosthesis fabrication, and adhesive cementation. At one-month follow-up, the restorations showed satisfactory esthetic integration, healthy gingival response, and excellent patient satisfaction. Digitally planned zirconia veneers can provide a predictable and minimally invasive solution for fluorosis-associated esthetic rehabilitation.

KEYWORDS

Dental Fluorosis; Digital Smile Design; High-translucency Zirconia Veneers; Anterior Diastema; Esthetic Rehabilitation

INTRODUCTION

Dental fluorosis is a developmental enamel defect caused by excessive fluoride exposure during amelogenesis, leading to hypomineralized enamel with altered translucency and intrinsic discoloration [1–3]. Esthetic concerns become more significant when the maxillary anterior teeth are affected, particularly in moderate to severe fluorosis cases associated with brown staining and surface irregularities [2,3]. In many patients, these changes negatively influence smile esthetics and psychosocial well-being [4].

Management of fluorosis-affected teeth is often challenging because of the intrinsic nature of discoloration and altered bonding characteristics of fluorosed enamel [5]. While bleaching and microabrasion may be effective in mild cases, their outcomes are limited in moderate to severe fluorosis [6,7]. Consequently, porcelain veneers have emerged as a predictable and conservative treatment option for masking discoloration while preserving tooth structure [8–10]. The presence of anterior diastema further complicates treatment, as both esthetic masking and correction of tooth proportions must be achieved simultaneously [11].

Advances in digital dentistry, particularly Digital Smile Design (DSD), have improved esthetic treatment planning by enabling detailed smile analysis and better visualization of expected outcomes [12]. In addition, high-translucency zirconia has gained popularity for anterior restorations because of its improved optical properties, strength, and ability to effectively mask discoloration [13]. However, limited literature is available regarding the use of digitally planned high-translucency zirconia veneers in fluorosis cases with anterior spacing.

This case report describes the digitally guided esthetic rehabilitation of fluorosis-affected anterior teeth with associated diastema using high-translucency zirconia veneers as a conservative and predictable treatment approach.

Case Presentation

A 31-year-old female patient presented to the Department of Prosthodontics and Crown and Bridge with concerns regarding

discoloration and spacing of the maxillary anterior teeth. Medical history was non-contributory, while dental history revealed prolonged fluoride exposure during childhood. Clinical examination showed generalized fluorosis-related enamel discoloration and a midline diastema between the maxillary central incisors, with healthy gingival tissues and Angle's Class I occlusion. Based on clinical evaluation and digital smile analysis, a diagnosis of moderate dental fluorosis with anterior diastema was established. The treatment objectives were to improve esthetics by masking discoloration, closing the diastema, and preserving tooth structure. After considering various treatment options, digitally planned porcelain veneers were selected as the most predictable esthetic solution.

WORKFLOW

The patient was first documented with preoperative extraoral and intraoral photographs and a digital intraoral scan, which revealed fluorosis-associated discoloration and anterior spacing (Figure 1A–D). Digital Smile Design was then performed to analyze facial reference lines, tooth proportions, smile symmetry, and the desired restorative outcome (Figure 2A–D). Conservative veneer preparation was carried out using depth-orientation grooves followed by controlled facial reduction and minimally invasive preparation of the maxillary anterior teeth followed by immediate temporization (Figure 3A–D). After preparation, digital impressions were obtained and the definitive high-translucency zirconia veneers were designed using CAD software (Figure 4A–B). Trial of unglazed high translucency zirconia (Figure 5A–C). Adhesive cementation was completed through conditioning of the zirconia intaglio surface, tooth surface pretreatment, resin cement placement, seating, and light polymerization (Figure 6A–H). Post-cementation intraoral views showed successful closure of the diastema, masking of fluorosis, and improvement in smile esthetics (Figure 7A–C). Comparison of pretreatment and posttreatment extraoral smiling views confirmed marked esthetic improvement (Figure 8A–B).

DISCUSSION

The esthetic rehabilitation of fluorosis-affected anterior teeth is challenging because fluorosed enamel presents with intrinsic discoloration, increased porosity, and altered bonding characteristics

[5]. Therefore, treatment should achieve effective masking of discoloration while preserving maximum tooth structure and ensuring long-term esthetic stability.

Porcelain veneers have been widely used for the management of moderate fluorosis due to their conservative nature and predictable esthetic outcomes [8–10]. Feldspathic ceramics provide excellent translucency but have limited strength, whereas lithium disilicate offers improved mechanical properties with satisfactory esthetics [10,14]. Recently, high-translucency zirconia has emerged as a promising material for anterior restorations because it combines enhanced strength with improved optical properties and effective masking ability [13]. In the present case, high-translucency zirconia veneers successfully masked fluorosis-related discoloration while maintaining conservative preparation dimensions.

The presence of anterior diastema further complicates treatment, as improper contouring may compromise esthetics and periodontal health [11]. Digital Smile Design allowed precise evaluation of tooth proportions and facilitated controlled space closure with improved smile harmony. Previous studies have also highlighted the role of digital planning in improving predictability and patient satisfaction in esthetic rehabilitation [12,15].

Although bonding to zirconia was previously considered challenging, contemporary adhesive protocols using MDP-containing primers have significantly improved bond strength and clinical reliability [16]. The successful outcome in the present case highlights that digitally planned high-translucency zirconia veneers can provide a predictable, minimally invasive, and esthetically satisfactory solution for fluorosis-associated discoloration with anterior spacing.

CONCLUSION

Digitally guided rehabilitation using high-translucency zirconia veneers provides a predictable and conservative solution for managing fluorosis-affected anterior teeth with associated diastema. Accurate digital planning, appropriate material selection, and adherence to evidence-based adhesive protocols are essential to achieve optimal esthetic integration, periodontal health, and patient satisfaction.



(A) Preoperative extraoral frontal view showing dental fluorosis associated with anterior spacing and compromised smile esthetics. (B) Pretreatment smiling profile demonstrating discoloration and diastema affecting the maxillary anterior region. (C) Retracted intraoral frontal view illustrating generalized fluorosis stains, enamel opacities, and spacing in the anterior dentition prior to treatment preparation. (D) Three-dimensional digital intraoral scan used for diagnostic evaluation and smile design planning before veneer rehabilitation.

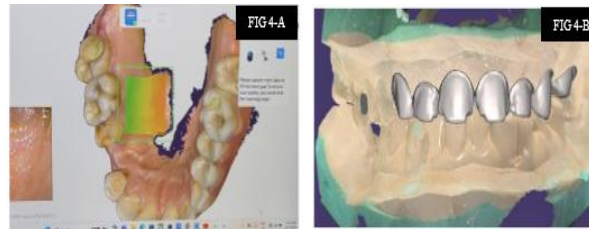
(A) Digital smile analysis performed using facial reference lines and intraoral calibration to evaluate tooth proportions, midline position, and smile symmetry before treatment. (B) Three-dimensional intraoral scan views demonstrating the pretreatment condition of the maxillary and mandibular dentition with fluorosis-related discoloration and spacing. (C) Digital smile design overlay used for esthetic planning and visualization of the proposed restorative outcome. (D) Three-dimensional printed study models fabricated from the digital scans for diagnostic assessment and treatment planning.



(A) Depth-orientation grooves placed on the maxillary anterior teeth using a depth-cutting bur to achieve controlled and conservative veneer preparation. (B) Facial reduction completed following preparation guidelines, maintaining enamel preservation for optimal adhesive bonding. (C) Minimally invasive tooth preparation of the maxillary anterior teeth performed according to the digitally planned veneer design. (D) Immediate temporization following tooth preparation, demonstrating provisional restoration of the maxillary anterior teeth to maintain esthetics, protect the prepared tooth surfaces, and guide soft tissue response until definitive veneer fabrication.



(A) Intraoral digital scanning procedure demonstrating acquisition of detailed preparation scans for computer-aided design and fabrication of veneers. (B) Digital model of the prepared veneer teeth showing the preparation design, finish lines, and restorative space prior to definitive veneer fabrication.



(A) Frontal intraoral view before cementation of unglazed high-translucency zirconia veneers demonstrating closure of anterior spacing and improved esthetic integration.

(B) Right lateral intraoral view showing harmonious contour, alignment, and shade matching of the definitive restorations.

(C) Left lateral intraoral view illustrating enhanced smile esthetics and functional occlusal relationship following veneer rehabilitation.



(A) Armamentarium used for adhesive luting of high-translucency zirconia veneers, including primer, resin cement, applicators, and finishing accessories.

(B) Preparation of the ceramic surface conditioning agent prior to application on the intaglio surface of the veneers.

(C) Application of ceramic primer to the internal surface of the zirconia veneers to enhance micromechanical and chemical bonding.

(D) Dispensing and mixing of Multilink N primer components according to the manufacturer's instructions before tooth surface conditioning.

(E) Isolation and pretreatment of the prepared teeth prior to adhesive cementation.

(F) Application of primer to the prepared enamel surface to optimize adhesive bonding.

(G) Placement of resin cement onto the intaglio surface of the veneer restoration before seating.

(H) Final seating and light polymerization of the veneer restoration to achieve definitive adhesive luting.



(A) Frontal intraoral view at follow-up demonstrating satisfactory esthetic integration, marginal adaptation, and maintenance of anterior veneer restorations.

(B) Right lateral intraoral view showing stable occlusal relationship and harmonious contour of the definitive restorations.

(C) Left lateral intraoral view illustrating functional stability and preservation of esthetic outcomes after veneer rehabilitation.



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