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Case Report

Ceramic Veneers for Smile Rehabilitation in Generalized Dental Fluorosis: A Clinical Case Report

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Abstract

Dental fluorosis is a common developmental condition affecting both primary and permanent dentitions, with more pronounced consequences in permanent teeth due to their lifelong function. In most cases, patients primarily seek treatment for esthetic concerns, while restorative interventions, once initiated, often entail long-term maintenance. Consequently, when functional impairment is minimal, treatment planning should favor minimally invasive strategies; however, in more advanced cases, aggressive approaches may be required, and patients should be thoroughly informed of the associated risks. The choice of treatment is therefore largely guided by the severity of the condition, with ceramic veneers frequently considered the treatment of choice for moderate to severe fluorosis owing to their superior esthetic properties, durability, biocompatibility, and predictable long-term performance.

This case report describes the partial management of generalized dental fluorosis in a 36-year- old Tunisian female patient using ceramic veneers. The patient presented to the dental clinic of Monastir with the main complaints of an unaesthetic smile and generalized tooth discoloration.

Keywords: *Dental Fluorosis; Smile Rehabilitation; Porcelain Veneers; Tooth Discoloration; Aesthetic Treatment*

Introduction

The global prevalence of dental fluorosis has shown a progressive increase in recent years [1]. While excessive fluoride exposure during enamel formation is a well-established etiological factor, insufficient fluoride levels are also associated with detrimental effects, particularly an increased susceptibility to dental caries [2]. Clinically, dental fluorosis is commonly linked to fluoride concentrations in drinking water exceeding 1.5 ppm [3] and manifests across a broad spectrum of severity, ranging from subtle enamel opacities-often presenting as faint white spots that may go unnoticed-to more severe forms characterized by enamel pitting and dark yellow to brown discoloration.

In most instances, patients seek treatment primarily due to aesthetic concerns related to tooth discoloration. The diagnosis of dental fluorosis is principally based on a documented history of fluoride exposure during the critical stages of tooth development, complemented by a comprehensive intraoral clinical examination. In contrast, radiographic investigations and adjunctive tests, such as pulp sensibility testing, offer limited diagnostic value in this context [4-7].

Given that the initiation of restorative treatment frequently implies long-term maintenance, a conservative and minimally invasive approach is recommended in cases presenting with minimal functional impairment. However, more severe forms may necessitate extensive therapeutic interventions, provided that patients are adequately informed about the potential risks and long-term implications [8,9].

This case report describes the step-by-step aesthetic rehabilitation of a patient presenting with moderate dental fluorosis using ceramic veneers.

Case Presentation

A 36-year-old female patient from Kairouan presented to the Department of Fixed Prosthodontics at the Dental Clinic of Monastir, seeking a solution for what she perceived as an unaesthetic smile. Her chief complaint was purely aesthetic, related to the color and shape of her anterior teeth. Clinical examination revealed a medium smile line, with approximately 75 - 100% of the clinical crowns visible without gingival display. Generalized tooth discoloration affected both the maxillary and mandibular dentitions. Two existing restorations were noted on the maxillary central incisors and canines. Black triangles were present between the four maxillary incisors, and the incisal edges of the maxillary central incisors were misaligned; however, the dental midlines were coincident.

The patient exhibited a class I occlusion, with an overbite and overjet of approximately 1 mm. Her smile extended from the maxillary right second premolar to the maxillary left second premolar, and facial analysis revealed overall symmetry. A panoramic radiograph confirmed that all teeth were vital, with no endodontic complications. Based on the clinical and radiographic findings, a diagnosis of moderate generalized dental fluorosis was established. The patient reported significant psychological discomfort and social embarrassment due to her dental appearance, leading her to avoid smiling. She expressed a strong desire for a definitive aesthetic solution to improve her confidence and well-being (Figure 1).

Figure 1A-1D: *Initial oral condition. A- Teeth in maximum intercuspation. B- Lateral view of the right side of the occlusion. C- Lateral view of the left side of the occlusion. D- Patient's smile.*

To preserve the natural dentition, a conservative, stepwise treatment approach was adopted. In-office bleaching was initially performed using 32% hydrogen peroxide for 45 minutes, followed by at-home bleaching with 16% carbamide peroxide. While this approach resulted in noticeable lightening of the teeth, the patient remained dissatisfied with the color and shape of her anterior teeth.

Prosthetic decision

To adhere to the principle of tissue preservation, the decision was made to restore the maxillary anterior teeth with ceramic veneers (IPS e.max® CAD).

Considering the patient's financial constraints, an initial set of eight veneers was fabricated, covering teeth #14 to #24. This approach allowed correction of the smile with a positive impact on the patient's psychological well-being.

Treatment plan

Digital impressions were obtained for diagnostic purposes, followed by a pre-prosthetic Digital Smile Design (DSD) analysis that was performed and presented to the patient to validate the proposed treatment outcome. Subsequently, a three-dimensional model was fabricated using CAD/CAM technology, from which a silicone index was prepared to enable the creation of an intraoral mock-up (Figure 2).

Figure 2A and 2B: *An intraoral mock-up.*

Tooth preparation was performed through the mock-up, which served as a guide for controlling the extent of reduction. The eight maxillary teeth were prepared using a flat-end tapered diamond bur, achieving a facial reduction of approximately 0.5 - 0.7 mm and an incisal reduction of 1.5 mm. A chamfer finish line was established at the gingival margin, and the proximal margins were extended into the facial and gingival embrasures to ensure optimal contour and integration (Figure 3). Temporary veneers were then fabricated and cemented using a non-eugenol provisional cement (Figure 4).

Figure 3: *Tooth preparations.*

Figure 4: *Temporary veneers.*

A digital impression of the prepared teeth was subsequently obtained, allowing for the design and fabrication of the final ceramic veneers (IPS e.max CAD) using CAD/CAM technology (Figure 5A-5C)). A clinical try-in was carried out with a dedicated try-in paste to evaluate marginal fit, interproximal contacts, shade, morphology, cervical alignment, as well as both static and dynamic occlusion. Finally, the veneers were definitively bonded using a light-cured resin cement (Variolink®), ensuring durable adhesion and optimal aesthetic outcomes (Figure 6).

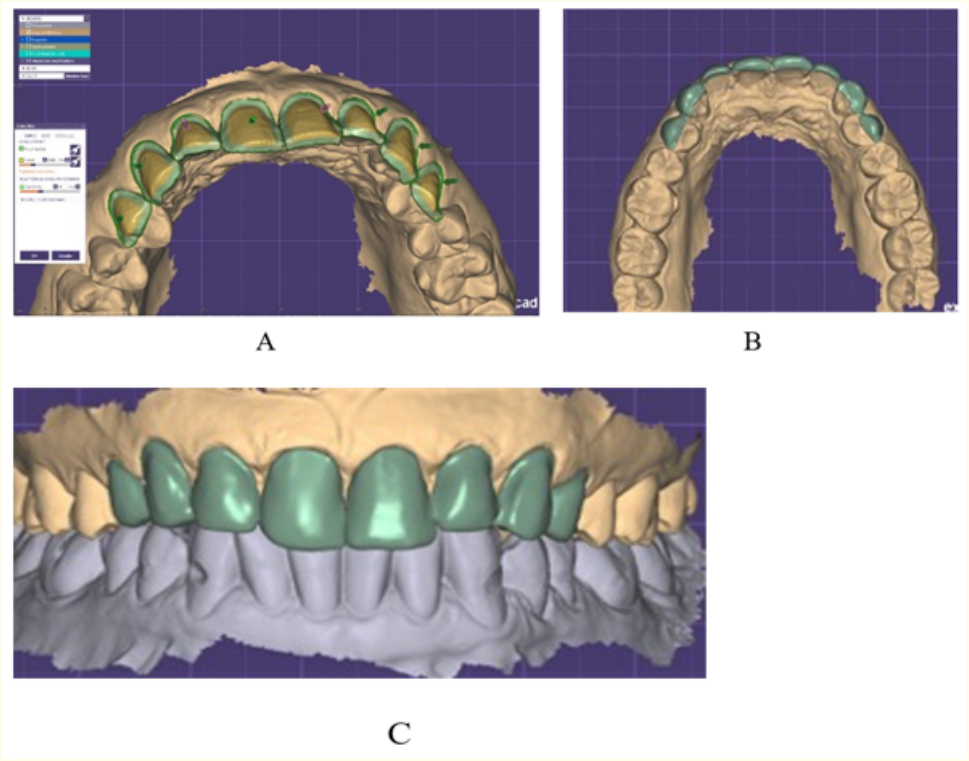

Figure 5A-5C: *Design of ceramic veneers using CAD/CAM technology.*

Figure 6: *Resin bonding (Variolink®).*

Veneer cementation procedure conditioning of the ceramic restorations

The external surfaces of the veneers were first protected with a high-viscosity silicone material to preserve their esthetic integrity (Figure 7). The intaglio surfaces were then rinsed with water and gently air-dried before being etched for 20 seconds using a hydrofluoric acid ceramic etching gel (IPS Ceramic Etching Gel). Following etching, the veneers were thoroughly rinsed and dried with an air stream. A silane coupling agent (Monobond-S) was subsequently applied to the internal surfaces for 60 seconds and lightly air-dried. Finally, a thin layer of adhesive resin (Heliobond) was applied, and the veneers were kept shielded from light until their placement.

Figure 7: *Protection of external surfaces of veneers with a high-viscosity silicone.*

Conditioning of the tooth preparation

A light-cured gingival dam was placed initially to protect the gingival tissues during the procedure. The prepared tooth surfaces were first rinsed with water and gently air-dried. Enamel was then etched for 30 seconds using 37% phosphoric acid (e.g. Total etch), while dentin, when necessary, was etched for 10 - 15 seconds (Figure 8). After thorough rinsing, the surfaces were carefully dried with air. A

dentin bonding system (e.g. Syntac) was subsequently applied following the manufacturer's recommendations: Syntac Primer was placed on dentin for 15 seconds and air-dried, followed by the application of Syntac Adhesive for 10 seconds with gentle air-drying. Finally, a thin layer of adhesive resin (Heliobond) was applied to both enamel and dentin, and excess material was dispersed with a mild air stream without light curing at this stage to preserve optimal seating of the restorations (Figure 9).

Figure 8: *Acid etching of the prepared tooth surfaces.*

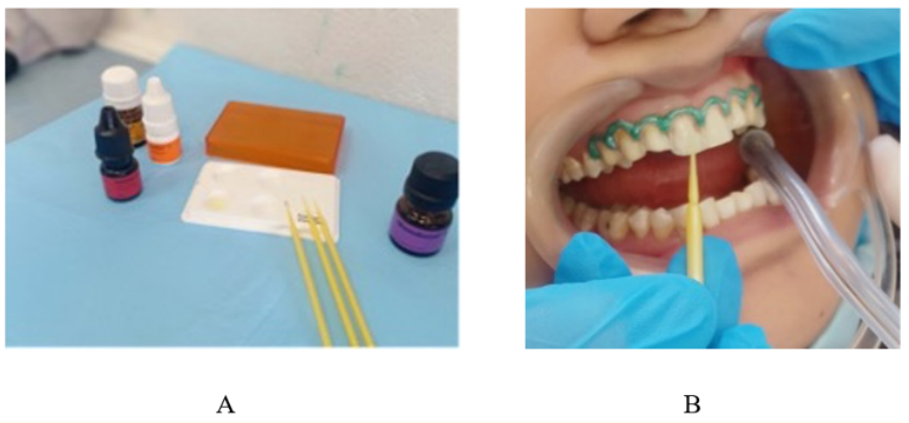

Figure 9A and 9B: *A dentin bonding system (e.g. Syntac) was subsequently applied following the manufacturer's recommendations.*

Insertion of the restorations

A resin cement (Variolink II) was applied to the intaglio surfaces of the veneers, which were then carefully positioned onto their corresponding teeth. Excess cement was removed, and the margins were covered with a glycerin gel (Liquid Strip) to prevent the formation of an oxygen-inhibited layer. Finally, the restorations were light-cured from all accessible aspects to ensure complete polymerization (Figure 10).

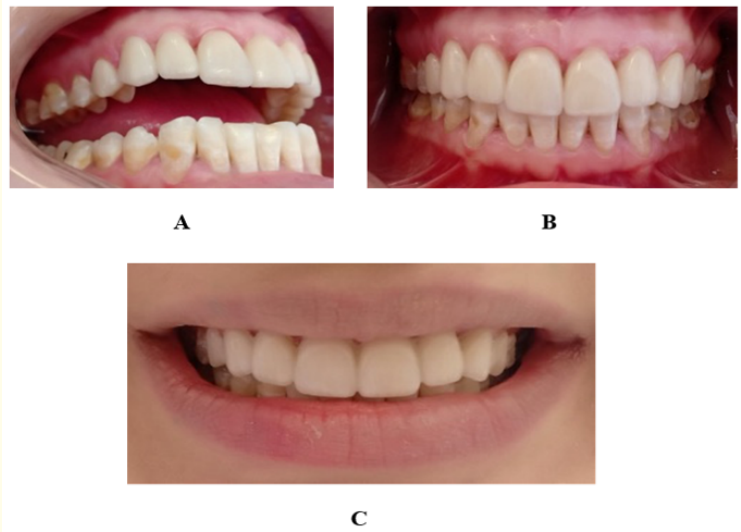

Figure 10A-10C: *Final result.*

Follow-up and postoperative care

Follow-up appointments were scheduled at 1 week, 1 month, and 6 months. Oral hygiene instructions were thoroughly explained to ensure proper maintenance of the restorations.

Outcome

The patient reported high satisfaction with the treatment. Periodontal health was maintained, and her oral hygiene improved. Psychologically, she regained self-confidence and exhibited positive social behavior, smiling freely. Despite only eight maxillary teeth being restored, the overall aesthetic improvement was significant, effectively addressing the patient's chief complaint (Figure 11A and 11B).

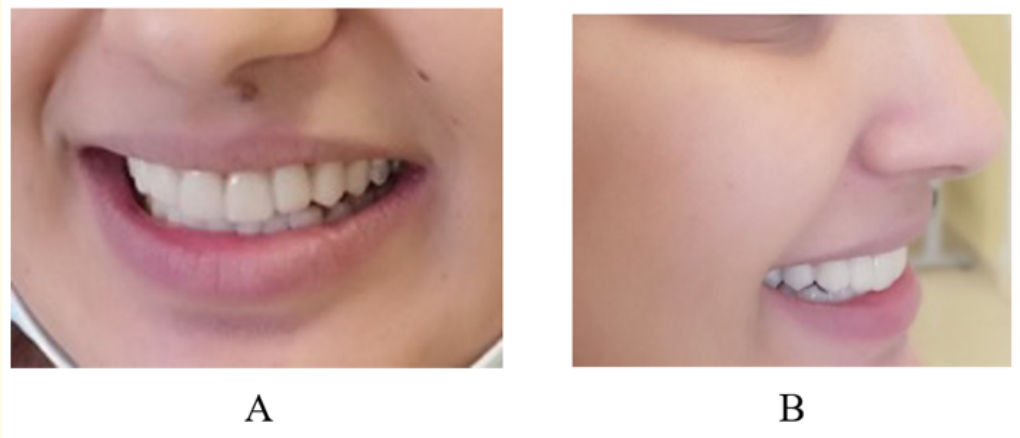

Figure 11A and 11B: *High satisfaction of the patient with the treatment.*

Discussion

Dental fluorosis exhibits a wide clinical spectrum, ranging from mild superficial enamel alterations-such as barely perceptible white opacities-to more severe forms involving enamel pitting and dark yellow to brown discoloration. In the majority of cases, the demand for treatment is primarily driven by aesthetic concerns related to these discolorations [4]. To facilitate a consistent and objective evaluation of fluorosis severity, several indices have been developed. Although primarily intended for use in epidemiological investigations, these indices require appropriate examiner calibration to ensure reproducibility and inter-examiner reliability. Among the most widely recognized are the Thylstrup-Fejerskov Index, Dean's Modified Fluorosis Index, the Tooth Surface Index of Fluorosis, and the Fluorosis Risk Index [10].

Code	Description
0	Enamel is normal: translucent, shiny, and smooth.
1	Questionable enamel: slight changes in translucency, insufficient to diagnose fluorosis.
2	Very mild dental fluorosis: small opaque white areas affecting less than 25% of the enamel surface.
3	Mild dental fluorosis: opaque white areas affecting less than 50% of the enamel surface.
4	Moderate dental fluorosis: opaque white areas affecting about 50% of the enamel surface; brown staining and wear may be present.
5	Severe dental fluorosis: marked pitting of the enamel surface; all tooth surfaces are affected.

Table 1: *The dean modified fluorosis index [11].*

In mild forms of dental fluorosis, where enamel alterations remain subtle, patients may be unaware of or unbothered by the aesthetic changes, and consequently, no treatment may be necessary. In such cases, management is primarily dictated by patient expectations, with therapeutic decisions largely driven by aesthetic concerns [7]. Vital tooth bleaching is widely regarded as an effective first-line approach for managing mild fluorosis; however, the concentration of hydrogen peroxide used varies across countries, as it is subject to regulatory frameworks governing the permissible levels of whitening agents [12].

Other minimally invasive strategies for mild to moderate fluorosis include enamel microabrasion and resin infiltration. Microabrasion consists of the controlled removal of the superficial fluorosed enamel layer, thereby reducing discoloration and improving aesthetic appearance, although its effectiveness may be limited in cases of deeper staining [7]. To overcome this limitation, combining microabrasion with dental bleaching has been shown to yield enhanced aesthetic outcomes. Resin infiltration, in contrast, involves etching the enamel surface with hydrochloric acid followed by the application of a low-viscosity resin that penetrates and occludes the porous enamel structure, significantly reducing the visibility of white lesions and improving overall aesthetics [7,13].

When these conservative approaches fail to provide satisfactory results, resin-based composite restorations represent the next minimally invasive alternative for masking discoloration. These can be applied either as localized restorations or as composite veneers, offering a more conservative option compared to conventional veneers, as they require little to no tooth preparation and thus better preserve sound dental tissues [7].

In cases of more severe fluorosis, where discoloration is pronounced and enamel quality may be compromised, indirect restorative options such as veneers or full-coverage crowns may be indicated to achieve optimal aesthetic outcomes. In particular, crowns may constitute the most predictable long-term solution when enamel integrity is insufficient, given that both composite restorations and veneers rely on durable enamel-resin bonding for retention [14].

Nevertheless, such indirect and more invasive restorative procedures may initiate a lifelong restorative cycle requiring periodic maintenance. Therefore, it is essential that patients are fully informed, and that treatment planning carefully balances potential risks and benefits. In certain clinical situations, a combination of therapeutic modalities may be necessary to achieve the most favorable aesthetic result [7]. Among these options, ceramic veneers offer a reliable solution for effectively masking discoloration while preserving maximum tooth structure, owing to their conservative preparation requirements and favorable optical properties [15,16].

Recent advances in dental ceramics have expanded the range of materials available for the fabrication of porcelain veneers, enabling clinicians to achieve restorations that combine high aesthetic quality with reliable functional performance [17]. In parallel, concepts related to tooth preparation for porcelain veneers have evolved considerably. Whereas earlier approaches emphasized minimal or even no preparation, contemporary strategies advocate a more selective and individualized reduction of tooth structure based on specific clinical requirements [15,16,18].

Whenever possible, tooth preparation should be restricted to enamel in order to optimize bonding efficacy. Although modern dentin adhesive systems have demonstrated encouraging clinical performance, adhesion to enamel remains superior in terms of bond strength compared with dentin [15,19]. Consequently, preserving preparation within intact enamel is considered a key objective, as it enhances the quality of adhesion and contributes to a more favorable distribution of functional stresses within the enamel-resin-ceramic complex [20].

Tooth preparation designs for porcelain veneers differ mainly at the incisal level, while more standardized principles apply to the cervical and middle thirds. In the cervical region, the finish line is typically placed at the level of the gingival crest or slightly subgingivally in anterior teeth. Achieving an optimal balance between sufficient reduction and enamel preservation in this area can be challenging; therefore, a minimal reduction of approximately 0.3 mm is generally recommended. In the middle third, preparation depth commonly ranges between 0.5 and 0.8 mm [20,21].

At the incisal level, several preparation designs are available, each with specific advantages and limitations. The “window” design is the most conservative, as it preserves the incisal edge; however, it may result in a visible interface between enamel, resin, and ceramic, and may increase the susceptibility to fracture. The “feather” design, which maintains the original incisal contour, can present difficulties in achieving precise positioning during cementation as well as optimal optical integration with the remaining tooth structure. In contrast, the “overlap” design allows for improved esthetic outcomes by providing sufficient space for a ceramic thickness of approximately 1.5 - 2.0 mm in the incisal third. In proximal areas, the preparation should follow the contour of the papilla and extend to the interproximal contact point [17,20].

Regarding restorative materials, lithium disilicate-reinforced ceramics represent a widely used option for veneer fabrication. These glass ceramics are characterized by a high crystalline content of approximately 70% and a refined microstructure, which contribute to enhanced flexural strength. In addition, their favorable translucency allows their use in full-contour restorations or, when superior esthetic results are required, in combination with veneering porcelain [22,23].

For the cementation of porcelain veneers, light-cured resin cements are generally preferred due to their favorable handling and optical properties [15]. A major advantage of these systems is their extended working time compared with dual-cured or chemically activated cements, which facilitates the removal of excess material prior to polymerization and simplifies finishing procedures. In addition, light-cured resin cements demonstrate superior color stability relative to their dual-cured and chemically cured counterparts [24]. However, their effectiveness depends on adequate light transmission through the ceramic restoration to ensure proper polymerization. While the shade and opacity of the veneer typically have a limited influence on light absorption [15,25], porcelain opacity becomes more critical when the restoration thickness exceeds approximately 0.7 mm [26]. Beyond this threshold, light-cured resin cements may fail to achieve optimal polymerization and maximum hardness. In such situations, the use of dual-cured luting composites is recommended,

as they incorporate both light- and chemically activated polymerization mechanisms. These materials not only ensure a more complete polymerization but also provide improved mechanical properties, including higher hardness values and enhanced bonding performance compared with purely light-cured systems [15].

In more severe and less frequent forms of dental fluorosis, both enamel and dentin structures may be compromised, leading to clinical manifestations such as dentin hypersensitivity, increased tooth wear, and enamel fractures [4]. Although minimally invasive techniques may still yield aesthetic improvements in such cases, advanced presentations often require more extensive restorative approaches, including full-coverage crowns. When such treatment options are considered, it is essential that patients are fully informed about the long-term implications, including maintenance requirements, potential need for replacement, and the risk of eventual tooth loss [9].

Prognosis

In mild to moderate cases of dental fluorosis, the prognosis is generally favorable, as patients are often asymptomatic and treatment is primarily guided by aesthetic concerns [7]. Minimally invasive therapeutic approaches have demonstrated high efficacy in managing these conditions, consistently resulting in elevated levels of patient satisfaction [13].

When indirect restorations are indicated, material and technique selection should prioritize the preservation of tooth structure while fulfilling the patient's aesthetic, functional, and biological requirements, in addition to ensuring adequate mechanical performance for long-term durability [27]. Among these options, porcelain veneers have been extensively studied and have demonstrated reliable clinical performance, with reported survival rates reaching approximately 93.5% over a 10-year period [28].

Conclusion

Restorative aesthetic dentistry should be practiced as conservatively as possible. Ceramic veneers are considered the ultimate option for a conservative aesthetic approach because they leave nearly all of the enamel intact before the veneer is placed.

This case report illustrates how ceramic veneers were used to aesthetically rehabilitate fluorosed teeth, leading to an enhanced smile and a notable improvement in the patient's self-esteem.

Conflicts of Interest

The author declares no potential conflicts of interest with respect to the authorship and/or publication of this article.

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