

## Aesthetic rehabilitation of severe dental fluorosis with Porcelain Veneers: About a case report

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### Abstract:

Dental fluorosis is a disturbance in the development of enamel caused by excessive fluoride on ameloblasts during the mineralization stage. This disturbance can induce subsurface porosities to varying extents depending on the severity of fluorosis. That is why patients with fluorosis consult dentist mainly for aesthetic reasons. Depending on the fluoride levels, the therapeutic options are multiple and vary according to their invasiveness from bleaching, microabrasion, veneering or crowning in the most severe levels with high surface enamel loss. Thus, the dentist should make an accurate diagnosis and choose the most appropriate therapy for the patient. Porcelain veneers can offer an excellent option to improve the smile aesthetics for patient with fluorosis. The purpose of this article is to report a case that shows the interest of porcelain veneers to manage successfully the aesthetics of moderate to severe fluorosed teeth.

**Keywords:** Dental fluorosis, discoloration, porcelain veneers, aesthetics

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### I. Introduction

It has been proven that smiling have benefits for health, it can increase general feelings of happiness by releasing endorphins and it can help lower stress and blood pressure [1]. The essentials of a smile involve the relationships between three primary components: colors and proportions of the teeth, the gingival scaffold and the lip framework [2].

Still, having an unpleasant smile can affect any patient's self-confidence. Moreover, the most common problem is the tooth discoloration and which is one of the important components of an ideal smile.

Fluorosis, as a dental disease, is one of many color anomalies of teeth. It is the result of chronic ingestion of fluorides in amounts exceeding the optimal daily dose of 1 ppm [3]. It is a developmental disturbance of enamel caused by excessive fluoride on ameloblasts during the mineralization stage [4].

In fact, fluorosed enamel is identified by an outer hypermineralized, acid-resistant layer. There is equally retention of more porous enamel in the areas of the subsurface hypomineralization [5, 6]. It is characterized too by a modification in the appearance of the tooth's enamel that can vary from barely noticeable white lines in mild forms to cloudy areas, staining and pitting in the more severe forms [5, 7, 8].

In addition to the aesthetic and functional concerns, the treatment of fluorosis is crucial to help improve a patient's self-esteem [9].

The purpose of the present paper is to describe and discuss the therapeutic approach by porcelain veneers when it comes to a case of severe dental fluorosis.

### II. Case report

A 43-year-old female came to our medicine dental department of prosthodontics for aesthetic management of discolored teeth. Her chief complaint was an unpleasant smile due to generalized tooth discoloration.

At the first appointment, she was irritable and aggressive and she could barely smile (Fig1), the medical history was non-contributory.

She was born in a region well known for a higher concentration of fluoride in potable water. Clinical examination revealed generalized enamel fluorosis affecting all teeth with a missing tooth, 25. The enamel

surface was opaque, sub-surface porosity was present on most of the surfaces of the teeth with wide spread yellow brown stains (Fig2). Furthermore, acceptable oral hygiene and a favorable occlusion were notified.



*Figure 1: Initial appearance of patient's smile*



*Figure 2: Preoperative photograph showing generalized dental fluorosis*

In this case, according to the 1978 dental fluorosis classification scheme of Thylstrup and Fejerskov (TSIF Index), the diagnosis of severe dental fluorosis was made with TFI= 7 [10].

Then, we explained to the patient the different treatment options including dental bleaching, micro abrasion, composite veneers, porcelain veneers and full coverage crown. We proposed as well a dental implant support crown to replace the missing premolar.

But after considering the severity of fluorosis, the deeply stained teeth, and the cost of treatment, our approach was to place 6 Porcelain Veneers on the upper teeth from 13 to 23 and a bridge in zirconium replacing 25; the abutment teeth are 24 and 26, and to restore the 14 with a full ceramic crown; as the remaining enamel of tooth 14 was insufficient for adhesive bonding. On the same, we informed the patient that the result would be much more efficient after restoring mandibular teeth, but she explained that she could not restore more than maxillary teeth due to her financial situation. However, she added that depending on the facial result, maybe she will restore the lower teeth.

### **III. Treatment protocols**

During the first appointment, preoperative photographs were taken as well as diagnostic impressions using irreversible hydrocolloid. A diagnostic wax up was done on the patient's maxillary study model to help assess the final treatment outcome.

We started preparing teeth 14, 24 and 26 by reducing a specific amount of tooth structure. The preparation of severely fluorosed teeth for porcelain veneers follows the usual general principles. It was to be minimal, and when possible, into enamel only [11].

Still, it has shown that the window type of labial enamel preparation should be avoided, rather, the incisal bevel preparation is preferable [12, 13, 14]. We used for tooth preparation a depth limiting bur which allows to place three horizontal facial depth cut, 0.3mm at the cemento enamel junction, 0.5 mm in the middle third, and 0.7 mm in the incisal third (Figure 3).



**Figure 3:** The Use of a depth-limiting bur to place three horizontal facial depth cut: labial reduction (a) second plane reduction (b)

The depth grooves were marked with a pencil. We placed a retraction cord to protect the gums. We reduced the incisal edge 1.5 mm and we used a diamond bur to prepare the facial surface and make a definitive chamfer finish line continuous with the facial-proximal outline. The chamfer margin was kept equigingival. With regard to the mesial and distal proximal surfaces, because of areas of brown interproximal staining, the preparation was more extensive. Finally, incisal line angles were rounded.

After the preparation we noted areas of exposed dentin, so we proceed to an immediate dentin sealing by applying a universal adhesive scotchbond (Fig 4). Then we evaluated the final preparation and the occlusion (Fig 5).



**Figure 4:** An immediate dentin sealing IDS using a universal adhesive Scotchbond



**Figure 3:** The final preparation

After that, a gingival retraction cord was inserted into the sulcus and a complete impression with a double viscosity polyvinyl siloxane material was made then sent to the laboratory after shade selection. Temporization was made using flow composite (Protemp 4).

Once the veneers and the zirconia framework were received from the technician, we checked their position on the master cast, and we made a try in to check the fit, the color and the contact points (Fig 6). Then we moved to the final step: the bonding using an etch-and-rinse adhesive luting (Variolink II, Ivoclar Vivadent, Liechtenstein) that is why we used a rubber dam to achieve proper isolation.



**Figure 6:** Try-in of the porcelain laminate veneers, the zirconia framework and check the fit, the color and the contact points

The internal surfaces of the veneers were etched with hydrofluoric acid for 20 seconds and then treated with silane coupling agent for 1 minute (Fig7). Prepared surfaces were etched for 30 seconds with a 37% phosphoric acid etchant gel. After that, teeth were rinsed and dried and dental bonding agent was applied to all prepared surfaces (Fig8).



**Figure 7:** Treating the internal surface of the porcelain veneers



**Figure 8:** Tooth conditioning: etching, (a) washing, drying (b) and bonding the prepared surfaces (c)

The veneers were transferred to the corresponding teeth beginning with the central incisors. The composite was light cured through the restorations for 5 seconds, excess was removed, and then we ended the polymerization for 60 seconds. These same steps were completed in succession on the canines and finally the lateral incisors. This order was followed as the central incisors hold the focal point of an aesthetic smile so no crown malposition can be tolerated to replace them. This however, cannot affect the smile appearance when occurring on the crowns replacing the lateral incisors. That is why we kept them until last.

At the next step, we checked the occlusion, and we cemented the crown on tooth 14 and the bridge replacing tooth 25 (Fig9). We made some adjustment using smooth diamond burs. After 24 hours, the patient came for control and we noticed how the porcelain veneers have allowed the creeping of the papilla into the interdental embrasures (Fig10).



**Figure 9:** cementing the crown and the bridge



**Figure 10:** The postoperative retracted view: frontal view after 24h showing the outfit of the papilla with the veneers (a), lateral view: left

The smile appearance of the patient had been dramatically changed. She was significantly pleased with the outcome (Fig11).



**Figure 11:** Improvement of the patient's smile: before treatment (a) and after (b)

#### **IV. Discussion**

The classification criteria of dental fluorosis made by Thylstrup and Fejerskov is appropriate for determining the modality of treatment, based on biological aspects of dental fluorosis [10]. Bleaching and enamel micro abrasion are a non-invasive procedure, and they are indicated in cases of TFI score of 0-4, which correspond to mild to moderate grade fluorosis [10]. Akpata suggested that mild fluorosis with TFI score of 1-2 should be treated by bleaching. In fact, the bleaching agent could remove the entrapped extrinsic stains as the subsurface porosities are superficial [15]. At TFI scores of 3-4, Akpata in 2001 explained that the subsurface porosities can be so deep-seated that the bleaching cannot reach the entrapped extrinsic stains alone. He suggested that bleaching should be combined with microabrasion to remove fluorosis stains.

In teeth with TFI= 1-3 the porous enamel zone is located about 80-100 $\mu$ m into surface enamel. As the microabrasion produces a loss of about 100 $\mu$ m of surface enamel, it can be recommended for treatment of mild fluorosis [10].

Moreover, it has been shown that teeth with TFI=5-7 should be treated with laminate veneers, and at TFI scores of 8-9, teeth should be crowned as more than 50% of enamel has been lost in such fluorosed teeth [15,16].

Therefore, based on the classification criteria of dental fluorosis made by Thylstrup and Fejerskov, we chose porcelain veneers as the best therapeutic option to mask tooth discoloration for our patient [17].

In fact, a retrospective evaluation of 191 porcelain laminate veneers over a period of 10 years showed that the estimated survival probability is 91% [18]. It has shown that they have good clinical success and high survival rates [19, 20]. They also have an excellent biocompatibility with gingival and periodontal tissues.

Before preparing the teeth, we made a diagnostic wax up, this enabled the patient to understand the final shape of her teeth. But the main problem of our patient was essentially the color, so using the digital smile design can be helpful to evaluate the final result. It helps us to understand the patient's requirements before suggesting any treatment.

In this case, the proximal contacts were involved in the tooth preparation due to the areas of brown interproximal staining. The incisal edge was reduced to have veneers with incisal coverage.

Indeed, Smales and al studied the clinical success rate of 110 ceramic veneers for seven years and they reported that there is a 96% success rate for incisal overlap design against 86% success in veneers without incisal coverage [21].

But the main dilemma here is about the efficiency of bonding porcelain veneers to fluorosed teeth, if it is the same as to non fluorosed teeth or not.

In this context, several studies have been done to evaluate the bond strength of porcelain veneers to fluorosed teeth. They have shown that the use of an etch-and-rinse adhesive luting procedure performs better than the use of the self-etch bonding system. Moreover, the etch-and-rinse dentin bonding system has no effect on the shear bond strength of glass-ceramics to both non-fluorosed and moderate fluorosed enamel surfaces [22, 23, 24].

It has also been demonstrated that the high fluoride content is concentrated in the outer 200  $\mu$ m [25]. This is in accordance with a study which states that preparation of enamel increased the resin-enamel bond strength in fluorosed teeth, and that the bonding effectiveness to unground enamel was lower in fluorosed teeth, as the outer hypermineralized enamel was not removed, than in non-fluorosed teeth for the self-etch adhesive tested [26].

On the other hand, in an in vitro study, it was found that the mean depths of etch with 37% phosphoric acid to mildly fluorosed enamel were not significantly different from the depth obtained for non-fluorosed teeth.

However, in cases of moderate and severe fluorosed teeth, the longer the acid-etching time with phosphoric acid to these fluorosed enamel surface, the higher the bond strength will be [7].

And to evaluate the effects of different etching concentrations of phosphoric acid on the microtensile bond strength to fluorosed teeth, a study has been shown that the bond strength increased with the increasing concentration of phosphoric acid, and the maximum bond strength was achieved by using 40% phosphoric acid [27].

Another study showed that, when bonding is performed on moderate and severe fluorosed enamel, the self-etch dentin bonding system is inferior to phosphoric acid etching [28].

In certain cases, dentin can be exposed in teeth prepared for porcelain veneers. A study investigated the effect of dental fluorosis on shear bond strength of a composite material to dentine, it has shown that fluorosis does not affect the shear bond strength when Clearfil SE Bond (Kuraray ESPE) was used as an adhesive [29].

Clearly, a proper care of the veneers after the end of the treatment and a regular dental check-up visits may increase their life with no complications.

## V. Conclusion

Many treatment options are available today to treat dental fluorosis. We can opt for a multi treatment approach. This case was successfully managed by the combined use of porcelain veneers and full crown. The patient's smile has been improved as well as her self-esteem.

The use of porcelain veneers may be considered as a treatment of choice to improve the aesthetic appearance of a patient with a severe dental fluorosis since it offers excellent conservation of underlying tooth structure.

The clinical success of porcelain veneers depends on the adequate indications of the cases and the correct application of the materials and techniques convenient for that.

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