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Aesthetic rehabilitation of a dental fluorosis case with porcelain laminate veneers

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Abstract---Fluorosis is a crippling disease and an ongoing challenge for India. It is a public health problem caused by excess intake of fluoride through drinking water, food products and industrial pollutants over a long period of time. Ingestion of excess fluoride, most commonly in drinking-water affects the teeth and bones. Repeated exposure to high concentrations of fluoride during tooth development, leading to enamel with reduced mineral content and increased porosity. Selection of appropriate treatment plan depends upon the severity of fluorosis. Porcelain laminate veneers are considered the treatment of choice for moderate to severe cases of fluorosis given the optimum aesthetics, wear resistance, biocompatibility, and long-term results of these veneers. This case report describes a step-by-step rehabilitation of dental fluorosis, using porcelain laminate veneers in a 28-year-old Indian female.

Keywords---aesthetic rehabilitation, dental fluorosis case, porcelain laminate veneers.

Introduction

Fluoride has always been considered as a “double edged sword”. It is well documented that fluoride can have both beneficial and detrimental effects on the dentition ever since Mc Kay and G.V. Black in 1916 published the effect of fluoride on dentition [1]. The beneficial effect of use of fluoride has resulted in caries protection whereas injudicious use has resulted in chronic fluoride toxicity,

which manifests as dental and skeletal fluorosis [2]. Endemic fluorosis is considered to be a major public health problem worldwide as well as in India. More than 60 million people are exposed to risk of fluorosis due to high concentration of fluoride in drinking water. Almost 230 districts of 19 states in India are endemic for dental and skeletal fluorosis, Maharashtra, being one of the affected states. Available literature shows that many areas in Maharashtra state are affected due to problem of fluorosis; major reason being consumption of water having high concentration of fluoride in the range of 0.8-10 ppm [3]

During the development of tooth, repeated exposure to high concentration of fluoride leads to dental fluorosis, mainly affecting the enamel mineralisation [4]. The severity of dental fluorosis depends on the 1) timing, 2) duration, 2) body weight, 3) degree of physical activity, 4) nutritional factors and 5) bone growth. Hence, it is highly individualised. The risk period for esthetic changes in permanent teeth is between 20 and 30 months of age. The recommended level for daily fluoride intake is 0.05 - 0.07 mg F/Kg/day, which is considered of great help in preventing dental caries, acting in remineralisation [5]. Daily intake above this safety level leads to dental fluorosis.

Mild form of dental fluorosis shows fully functional enamel with the presence of opaque striations and a mottled appearance, while more severe cases are characterised by enamel surface porosity, pitting, and dark discolorations.[6] Dental fluorosis especially in grown individuals create an esthetic as well as psychological concern. There are many treatment options available, depending on the severity of dental fluorosis. Bleaching and microabrasion can be done for milder cases of dental fluorosis, however these treatment modalities shows transient improvement [8]. Composite restorations are prone to chipping, debonding and discoloration. Porcelain veneers are the restoration of choice for moderate to severe cases of fluorosis given their colour maintainability, wear resistance, and biocompatibility [9].

Case report

A 28-year-old female patient from Satara district of Maharashtra was referred to the bhartividyapeeth, dental college and hospital, pune. Her chief complaint was an unpleasant smile caused by generalized tooth discoloration. Her medical history was irrelevant. Her brother, who lived in the same area as the patient (khatav, Satara), also had discoloured teeth. It is possible that they had all consumed the same water supply since their childhood. Maharashtra, India is under moderately affected states with fluorosis as per national health portal (India)

Clinical Examination

Clinical examination of the patient revealed generalised enamel fluorosis affecting all permanent teeth (Figure 1). Loss of the outermost enamel in irregular areas involving less than half of the entire surface presented on most surfaces of the maxillary and mandibular teeth. In this case, based on the Thylstrup and Fejerskov index (TFI) for dental fluorosis classification, the dental fluorosis was classified as TFI = 4 [10].



Figure 1 generalised enamel fluorosis affecting all of the permanent teeth.



Figure 2

Preoperative clinical photographs: (a) frontal view, (b) lateral view: right side, and (c) lateral view: left side.

Treatment Plan

After the clinical examination, radiographs, preoperative photographs, and upper and lower alginate impressions for diagnostic models were taken. The patient was presented with treatment options, which included ceramic or composite veneers, along with the advantages and disadvantages of each option. The patient agreed to smile enhancement using ceramic veneers for her upper teeth given that she desired an optimum aesthetic and a long-term result. The veneers would be placed on the patient's upper teeth, from her upper right 2nd premolar to upper left 2nd premolar. The patient decided to postpone veneering her lower teeth, given her limited financial capacity. Diagnostic models were analyzed to evaluate the occlusion, and a diagnostic wax-up was made of white-colored wax figure 2. The use of the wax-up allows the patient to preview the desired appearance of her teeth, and this wax-up is also essential for the fabrication of temporary restoration.



Figure 2 a diagnostic wax up

Tooth Preparation

The desired shade was selected using the VITAPAN classical shade guide (VITA Zahnfabrik, Germany). The enamel of the eight maxillary teeth was prepared using a flat-end tapered diamond bur to a depth of 0.5–0.75 mm facial reduction with 1.5 mm incisal reduction. A chamfer finish line was maintained at the level of the gingival margin. The proximal margin was extended till the contact area, but contacts between adjacent teeth were preserved.



Figure 3 final preparation (a) right lateral view (b) left lateral view

Final Impression and Temporization

Following tooth preparation, gingival retraction was achieved using retraction cords (company) soaked in a hemostatic agent. Impressions were taken with a polyvinylsiloxane material (company). The impression material was manipulated according to the manufacturer's instructions. Temporization was performed by spot etching on the facial surface of each prepared tooth with 37% phosphoric acid (Total Etch, Ivoclar Vivadent, Schaan, Liechtenstein). Bonding agent (OptiBond Solo Plus, Kerr, Orange, CA, USA) was applied on the enamel-etched spots and light cured for 20 seconds using a high-intensity light-emitting diode (LED) curing light (Elipar S10, 3M ESPE, MN, USA). The clear matrix that was previously fabricated was loaded with a temporization material (Protemp Plus, 3M ESPE, MN, USA) and placed over the prepared teeth. Light curing was done for 10 seconds per tooth. Then, the matrix was gently teased away from the prepared teeth. A number 12 scalpel blade was used to remove the partially cured temporization material. Facial and lingual embrasures were refined with a thin

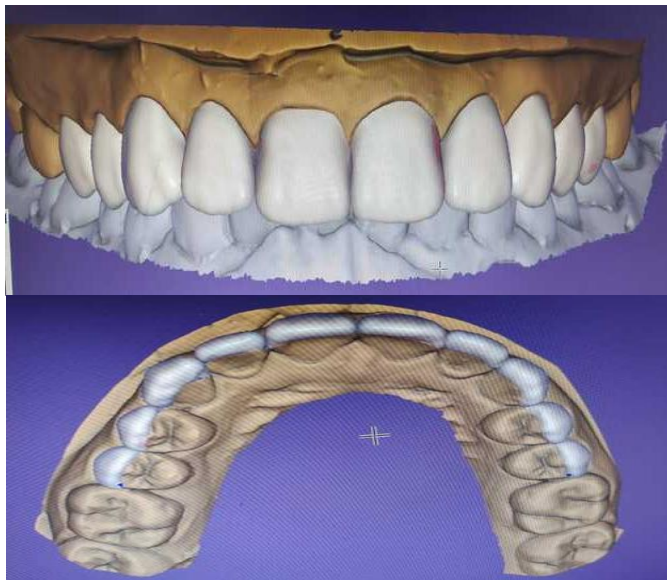
diamond disk, the occlusion was adjusted, and the temporary restorations were polished using polishing discs and points.



Figure 4 final impression



Figure 5 maxillary teeth after provisionalization



Veneer Try-In and Cementation

Ceramic veneers were fabricated with a lithium disilicate-reinforced glass ceramic material (IPS e.max Press, Ivoclar Vivadent, Schaan, Liechtenstein). Temporary veneers were removed, and the teeth were cleaned using pumice. Ceramic veneers were tried-in using a veneer cementation guide.



Figure 6 veneer bake trial



Figure 2 final restoration bonded (a) frontal view (b) occlusal

Afterwards, veneers were prepared for bonding. Fitting surfaces of the veneers were etched with hydrofluoric acid (Porcelain Etchant 9.5%, Bisco Inc., Schaumburg, IL, USA) for 60 seconds, washed under running water for another 60 seconds, and dried with an air syringe. A layer of silane coupling agent (Monobond Plus, Ivoclar Vivadent, Schaan, Liechtenstein) was applied on the veneers' fitting surfaces and gently air-dried after one minute. Then, the prepared teeth were etched using 37% phosphoric acid for 30 seconds, rinsed, and dried. A clear mylar strip was placed interproximally to prevent inadvertent bonding to the adjacent tooth and to facilitate the subsequent removal of excess resin cement in the embrasures. A layer of bonding agent (Adhese Universal, Ivoclar Vivadent, Schaan, Liechtenstein) was applied on the prepared tooth surfaces and air-thinned. Then, Heliobond (Ivoclar Vivadent, Schaan, Liechtenstein) was placed on the prepared tooth surfaces. The inner surface of the veneers was covered with light-cured resin cement (Variolink Veneer, transparent shade, Ivoclar Vivadent, Schaan, Liechtenstein). Veneers were positioned appropriately on the teeth by applying gentle pressure, following which excess resin cement was carefully removed with an explorer before light curing. Light curing was first performed for 2 seconds, and the excess resin cement was removed with a microbrush. After that, each veneer was light-cured from the facial aspect for 40 seconds and from the lingual aspect for 40 seconds. The two veneers of the central incisors were first simultaneously cemented. This was followed by cementation of the veneers of

the two lateral incisors. Then, the veneers of the two canines were cemented. Finally, veneers for the first and second premolars were cemented simultaneously on each side.

Minimal gingival flash of the resin luting cement was removed with a number 12 scalpel blade. A flame-shaped fine diamond bur was used to finish the ceramic margins and to contour the embrasure surfaces. Occlusion was assessed and adjusted. Flossing was performed to ensure interproximal contact patency. Ceramic polishing was performed using a series of polishing cups and points (OptraFine polishing system, Ivoclar Vivadent, Schaan, Liechtenstein). Interproximal contacts were finished with finishing and polishing strips. Final surface lustre was achieved by using a diamond polishing paste with a rubber prophylaxis cup. The postoperative clinical photographs are shown in Figure. Post op instructions were given to the patient. The patient was satisfied with the final result (Figure 7).

Discussion

Various treatment options have been recommended for the treatment of dental fluorosis ranging from minimally invasive treatments, like tooth whitening or micro-abrasion, to more extensive prosthetic rehabilitations with fixed restorations [8]. The treatment decision depends on the extent and severity of the condition, as well as the patient's esthetic expectations. In mild to moderate cases, the less invasive modalities should be attempted first, In severe cases of dental fluorosis, the enamel has a tendency to flake and fracture, which results in significant discoloration and substantial defects in the enamel structure necessitating the use of indirect restorations. The effects of fluorosis can vary widely by tooth within an individual [9].

In the present case, the patient presented with severe fluorosis affecting a majority of the maxillary dentition and several mandibular teeth. Patient had already done bleaching treatment a year back because of esthetic concerns, but she was not satisfied with the results. Keeping in mind patient's esthetic concerns a treatment plan of ten veneers in maxillary arch from second premolar to second premolar was formulated.

Lithium disilicate was selected as the restorative material for this case due to its proven clinical success [10,11], the need for predictable bonding to enamel and dentin [12], favorable esthetics, and more conservative preparation requirements. Despite the compromised bonding surfaces of fluorosed enamel, in vitro studies have shown improved bond strengths to enamel when incorporating phosphoric acid etching in moderately and severely fluorosed teeth [13].

Conclusions

Dental fluorosis can manifest in a variety of different presentations with varying severity and extent even within a single individual. Thus, the appropriate treatment decision must be reached through a thorough evaluation of the conditions of the affected teeth, as well as the overall functional and esthetic needs of the patient. In this case report, aesthetic rehabilitation was completed

with adhesively bonded lithium disilicate restorations on ten maxillary teeth from premolar to premolar to achieve a favorable and predictable treatment outcome. All-ceramic restorations are a viable option in the successful functional and esthetic management of moderate to severely fluorosed permanent dentition.

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