

Aesthetic treatment of severely fluorosed teeth with prefabricated composite veneers: a case report

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Abstract

Dental fluorosis is the retarding of tooth mineralization due to excessive fluoride consumption during tooth development. Its manifestation ranges from mild white opacities of intact enamel, to dark staining and severe destruction of tooth tissue. This case report describes the treatment of severely fluorosed maxillary anterior teeth in a 29 year old male, with indirect, prefabricated, composite veneers. An aesthetic result that accommodates a patient's financial means and that restores the smile can be achieved by the general dentist using this technique.

Keywords: fluorosis, indirect composite veneers

Introduction

Dental fluorosis is endemic to many parts of the world, including South Africa, which reports more than 20% of children affected.¹ The global prevalence of dental fluorosis has been reported to be around 32%.² A 20 year review of the literature on dental fluorosis shows a definite increasing

trend, be it fluoridated and non fluoridated water regions.³

Dental fluorosis was first described in 1916 by GV Black and FS McKay.⁴ The process occurs beginning with fluorides being absorbed via the stomach and small intestine, and then largely excreted via the kidneys. Any ingested fluoride is stored in the mineralized tissues – bone, teeth – and at a level that increases with age.⁵ Odontogenesis is a sequential process moderated by epithelial-mesenchymal interaction.⁶ The interactive processes result in the secretion of tissue specific proteins, the transport of ions, and then the precipitation of these ions in to enamel crystal form, viz amelogenesis. Ameloblasts in this process are responsible for the regulation of the mass transporting of ions from systemic circulation to local circulation, and back again. Ameloblasts are also responsible for both protease and protein synthesis. Amelogenin, ameloblastin, and enamelin are important examples of such proteins.⁷ These proteins are responsible for the tissue architecture which will result in enamel prism formation, and the orientation of the crystal structures within these. Proteases act on the secreted enamel proteins by creating soluble cleavage products, providing areas of the enamel structure to mineralize further. This mineralization is achieved by forming octa-calcium phosphate crystals, and thereafter by reinforcing these crystals in to sheet-like structures.⁸

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Fluoride induces nucleation and growth of these crystals. Fluoride precipitates calcium phosphate.⁹ Fluoride thus plays a vital role in tooth development.¹⁰ Dental fluorosis occurs via the exact same process evident in tooth mineralization and enamel formation. Excess fluoride retards the cleavage of secreted enamel proteins. That is to say, fluoride in excess during the tooth formative stage damages ameloblast cell product. At higher concentrations, fluoride retards the enamel matrix from calcifying properly.⁵ Histologic evidence of ameloblast cell damage can clearly be demonstrated in dental fluorosis. The clinical manifestation thereof may be widely diverse, varying from (i) suspect changes in enamel seen as white flecks, to (ii) mild changes and white opaque areas involving more of the tooth surface, to (iii) moderate and severe changes in tooth tissue seen as pitting and mottling of the surfaces, with or without brown to black staining, to even (iv) severe corrosion of tooth surfaces.^{11, 12}

Selecting between non-invasive, minimally invasive, and invasive restorative procedures to aesthetically treat such fluorosed teeth, pose a significant challenge to the restorative dentist.¹³ An understanding of all available treatment modalities is vital to the dentist's approach. Minimally invasive microabrasion techniques are limited to minor enamel defects.¹⁴ Severe, intrinsic staining of teeth may successfully be masked with the use of dental ceramics, or direct restorative dental cements.^{15, 16, 17} A newer alternative may also be utilized: restoring in a single visit with indirect, prefabricated composite veneers: Compoeneers (Coltène Whaledent). The manufacturers claim this to be an easy to use system for the restoration of anterior teeth. They are polymerized, prefabricated nano-hybrid composite shells. Other claims and features include a micro-retentive bonding surface, being extremely thin (0.3mm) for conservative tooth preparation, and having a wide range of clinical applications. The purpose of this study was to improve the aesthetics of a patient's smile, having suffered severe dental fluorosis, with the use of this Compoeneer system.

Clinical Report

A 29 year old male presented to a South African Military Health Service (SAMHS) dental clinic seeking treatment of his discoloured teeth (Figure 1a; Figure 1b). A detailed dental and medical history was obtained. The patient reported his confidence and smile having suffered as a result of his appearance. A social history reports the patient to have grown up in Polokwane, Limpopo, South Africa, and having abundantly drunken borehole water as a child. The overuse of fluoride supplements and fluoride containing dentifrices was ruled out. Intraoral examination identified all of the teeth as affected. Their appearance ranged from chalk-white

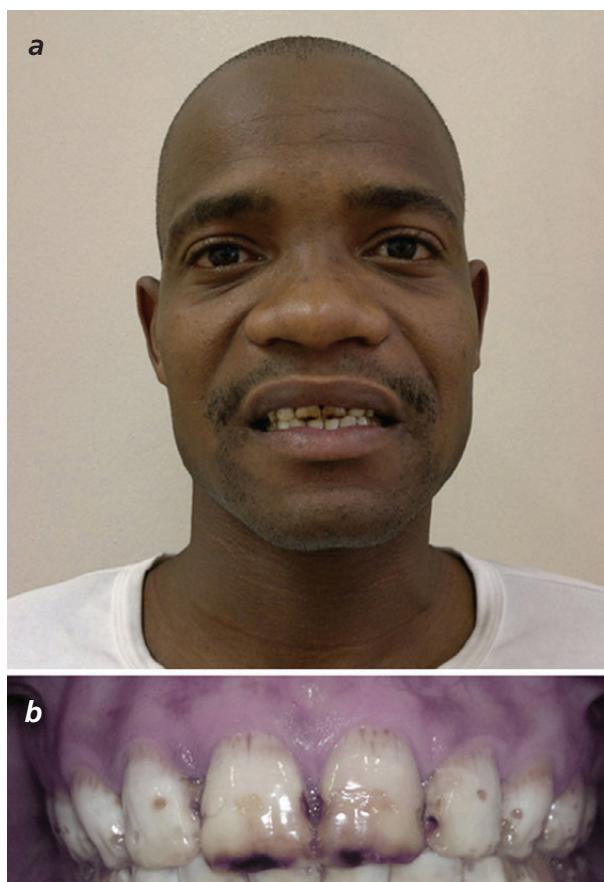


Figure 1a: Pre-restorative profile of the patient, with obvious reluctance to smile widely.

Figure 1b: Close-up of the pre-restorative dentition.

enamel, with and without pitting, to severe mottling with dark brown to black intrinsic staining. The maxillary central incisors, the most relevant teeth from an aesthetic viewpoint, were affected worst (Figure 2). The periodontal health of the patient was within adequate requirement, good oral hygiene was apparent, and the teeth free of dental caries. A diagnosis of severe dental fluorosis was made according to the Dean's Index, TSIF Index, and Moller's Index.^{18, 19, 20}

Occlusal and masticatory function did not require restoring. The pathophysiology of his condition was explained in detail. The patient's main concern was rehabilitation of his smile. Reassurance and all possible treatment modalities were offered. The patient expressed concern for loss of tooth structure incurred by full coverage restorations, and for cost of treatment. A compromise between need for restoration significant enough to mask the dental staining, for provision of aesthetics, with minimized loss of tooth tissue, and at a lesser cost was reached by opting for treatment by indirect, prefabricated, composite veneers (Figure 3). Six maxillary anterior teeth were planned



Figure 2: Extent of the affected, fluorosed teeth.

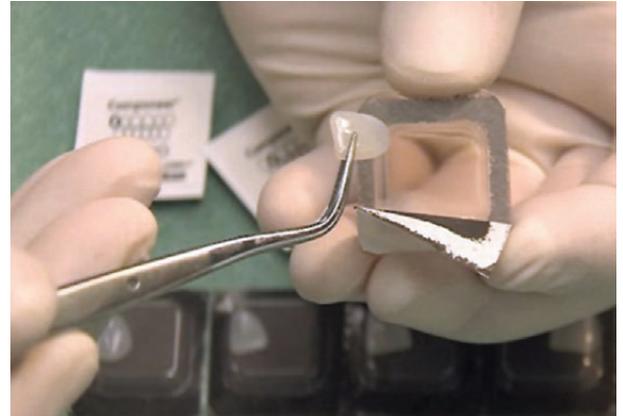


Figure 3: The prefabricated composite veneer.



Figure 4: The restorative armamentarium.



Figure 5: Mould and size taken with the veneer guide.

for treatment by this technique – maxillary canines, lateral and central maxillary incisors. The patient gave informed consent for photography and treatment, and for the documentation thereof.

The Composeer system was selected (Coltène Whaledent) (Figure 4). Shade taking proved significantly difficult. Aside from staining and mottling, the majority of the patient's enamel had a value lighter than an available composite to match. A universal shade intrinsic to the product's options was selected, with hue and chroma as accurate as was possible. Veneer mould and sizes corresponding to the prefabricated restorations was selected (Figure 5). The maxillary central incisors were anaesthetised with small amounts of dental local anaesthetic, as extended preparation of the deeper intrinsically affected incisofacial portions of these teeth was foreseen. The remaining four teeth to be treated required no anaesthesia. Preparation was to be minimal, and where possible, in to enamel only. The working

field was isolated and teeth prepared accordingly (Figure 6). Areas of black-brown interproximal staining required extension of preparations in to these isolated areas, namely between the central incisors.

The size and moulds required were re-checked, and the corresponding veneers adjusted where needed using a dry, low speed abrasive disc. Tooth margins and prepared surfaces were then etched for 15 seconds with a 37% phosphoric acid etchant gel (Scotchbond Universal, 3M ESPE). Teeth were rinsed and dried, and thereafter separated by interproximal matrices. A dental bonding agent (One Coat® Bond, Coltène Whaledent) was applied to all prepared surfaces and light cured for 20 seconds. A similar layer of adhesive was applied to the bonding surface of the veneers and thereafter a thin layer of composite (Synergy® D6, A1 enamel shade, Coltène Whaledent) evenly distributed with accurate marginal adaptation. The veneers were transferred to the corresponding teeth, beginning with



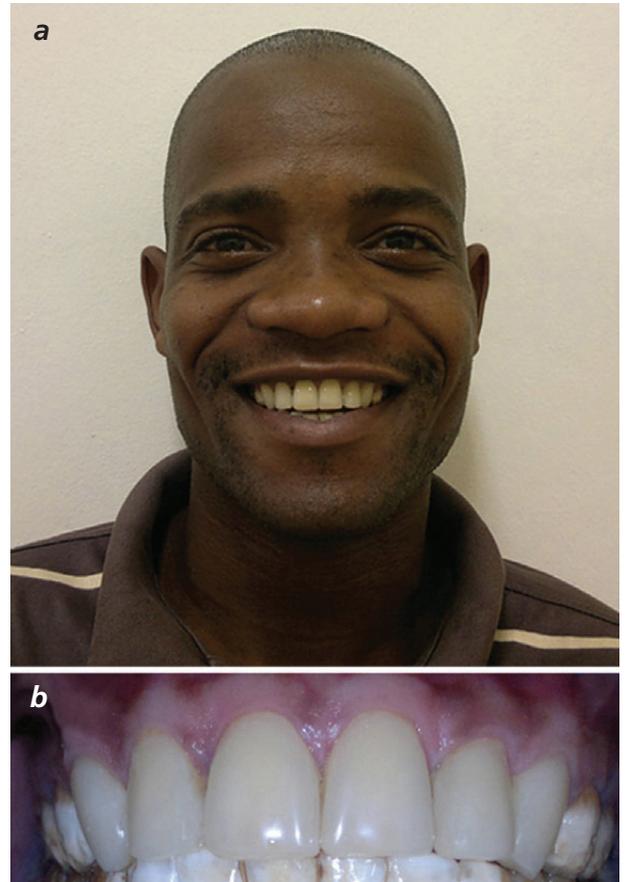
Figure 6: The prepared teeth in an isolated working field.

the central incisors. The two restorations were both aligned and pressure applied to adapt the composite. Excess was removed, margins smoothed, and occlusal plane as well as compeoneers' relation to long axes of the teeth were checked. The composite was light cured through the restorations. The aforementioned steps were repeated in succession, from central incisors, to lateral incisors, and lastly the canines. Contours and occlusal interferences were adjusted with a high speed bur and margins were refined and polished as needed. Treatment took place in a single visit, lasting in this occasion 3 hours from start to finish. The patient was significantly pleased with the outcome (Figure 7a; Figure 7b).

Discussion

Consensus is not apparent in the literature on adhesive bonding and dental fluorosis. Studies report microleakage to increase when etching and bonding to fluorosed teeth.²¹ Bond strength is reported to decrease when bonding orthodontic brackets to fluorosed teeth.²² Literature cites the quality of fluorosed enamel to having an adverse effect on bonding, and difficulty in achieving such a bond.²⁴ This is said to be as a result of hypermineralization by fluoride, rendering etching agents less effective in treating fluorosed tooth surfaces.^{25, 26, 27} Other reports show no difference in bond strength of adhesive agents to normal and fluorosed teeth.²³ The literature advises the use of a total etch system, aided by an adhesion promotor – a HEMA and polyalkenoic acid containing primer – for more predictable bonding results.²⁸

Restoring with the use of a dentinal bonding agent, dental composite, and prefabricated composite veneers is a viable option for treating severely stained and fluorosed teeth. A high degree of aesthetics can be realized. Tooth morphology



7a: Post-restorative view of the patient's smile at 3 months follow up; a noticeable change in self-confidence.

Figure 7b: Close-up of the restored maxillary anterior teeth.

of the indirect restoration may supersede that of the dentist's direct composite veneer. Cost of treatment is significantly less than dental ceramics ; approximately 500 Rands (60 USD) versus 1900 Rands (230 USD). The method described herein is technique sensitive. Tooth preparation requires the same skill and accuracy as is needed with porcelain veneer treatment. Adhesive procedures require properly integrating multiple interrelated steps in the restorative process, increasing the potential for error.²⁹ These veneers are not applicable to all severities of dental fluorosis. Minor fluorosis may not warrant the invasive removal of tooth structure.¹⁴ Indications should be accurately observed and tooth tissues preserved. Pleasing results can be achieved by a general dentist, and in a single visit. A 3 month follow up after treatment demonstrated a confident and satisfied patient. All restorations were fixed in place, aesthetics were very good, margins sound, and with no staining nor discoloration.

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