Re-establishing Esthetics of Fluorosis-Stained Teeth Using Enamel Microabrasion and Dental Bleaching Techniques

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Abstract

Dental fluorosis manifests itself as white stains on the enamel of teeth exposed to excessive doses of fluoride during their formation. Fluorosis usually occurs as a result of the ingestion of dentifrices, gels and fluoridated solutions. It may be diagnosed as mild, moderate or severe, and in some cases, it may cause the loss of the surface structure of dental enamel. The aim of this study was to report the clinical case of a female patient of 18 years with moderate fluorosis, whose smile was reestablished by the use of an enamel microabrasion technique, followed by in-office bleaching. A microabrasion technique with 6% hydrochloric acid associated with silica carbide showed to be a safe and efficient method for removing white fluorosis stains, while dental bleaching was useful for obtaining a uniform tooth shade. The association of these techniques presented excellent results and the patient was satisfied. Both techniques are painless, fast and easy to perform, in addition to preserving the dental structure. Treatment showed immediate and permanent results; this technique must be divulged among professionals and their patients.

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Clinical significance

The association of enamel microabrasion and dental bleaching techniques has been shown to be efficient elements for the recovery of the esthetics of teeth with moderate fluorosis. It occupies an outstanding place among treatment options, especially as it is a conservative treatment alternative to preserve the dental structure.

Introduction

Tooth color change may be a result of intrinsic or extrinsic causes. Changes in enamel as a result of external factors are more frequent, and occur due to the deposition of substances such as tea, coffee and tobacco. The intrinsic causes are inherent to defects in tooth development and systemic conditions, such as: dental traumatism, which may lead to hemorrhage inside the pulp chamber and tooth darkening; enamel hypoplasia; amelogenesis imperfect; dentinogenesis imperfect, and systemic ingestion of antibiotics (tetracycline) during tooth formation as well as dental fluorosis.\(^1\)

Fluorosis is the result of chronic fluoride intoxication, caused by excess ingestion going beyond tolerable limits for a prolonged period of time. The severity of this chronic intoxication will depend on the quantity of fluoride ingested, the duration of this exposure and the stage of tooth development in which the exposure occurred.\(^2\)

There are several resources in dentistry to correct esthetic alterations caused by staining, either with the use of porcelain laminate veneers, crowns or restorations with direct resin composite. However, all these procedures are considered invasive, since they require significant wear of the dental structure.\(^3\)

Problems due to intrinsic color changes in the enamel surface, which were previously resolved by wearing the tooth and later reconstructing it with direct and indirect materials, are now esthetically solved by means of more conservative techniques, using abrasive substances associated with chemical solutions for the purpose of correcting surface irregularities present in the tooth enamel.

A study conducted by Ardu S et al\(^4\) described an easy technique to solve small surface defects in cases of mild to moderate fluorosis. Surface abrasion of enamel with an esthetically pleasing result could be achieved by in-office bleaching.

Nowadays, the most popular technique used to improve the esthetic appearance of teeth with fluorosis is enamel microabrasion. This type of treatment, which is easily performed, associates the use of acid with abrasive particles to remove the stains from the tooth structure superficially, offering a more conservative approach, with minimal loss of enamel surface structure.\(^5\)\(^-\)\(^7\)

The first report that described applying acid to remove fluorosis stains was by Dr Walter Kane in 1916, who used 18% hydrochloric acid and pumice stones, without the use of heat, until the desired shade was obtained.\(^1\)

One study presented a product (Opalustre\(^\text{®};\) Ultradent Products, South Jordan, UT, USA) composed of 6.6% hydrochloric acid associated with silica carbide microparticles which, among other advantages, offered both the
professional and the patient a good safety margin during application. The use of 37% phosphoric acid or 18% hydrochloric acid has been effective for removing enamel opaque spots caused by fluorosis. However, the use of phosphoric acid results in increased surface roughness and lower depth of enamel demineralization, when compared with hydrochloric acid.

Microabrasion is usually performed before bleaching when white surface discolorations are eliminated and the enamel surface becomes brighter and shinier. White spots due to demineralization or decalcification defects are not improved by dental bleaching, but they may often be permanently eliminated with enamel microabrasion.

Case report

The patient, a female university student of 18 years, presented at the restorative dental clinic with the main complaint of the presence of white spots, suggestive of fluorosis, in all the maxillary and mandibular teeth (Fig 1). The patient reported having used fluoridated dentifrice (Tandy®; Kolynos do Brasil, São Paulo, Brazil) containing a large amount of fluoride (1.100 ppm) throughout her entire childhood, and that she frequently ingested it. The ingestion of fluoridated toothpaste quite possibly had an important role in the development of dental fluorosis, since the town in which the patient resided at the time had not incorporated fluoride in the public water supplies. During the patient’s clinical evaluation, no caries could be detected and the diagnosis of fluorosis was confirmed.

A smile with pleasant esthetics can be extremely important in an individual’s interpersonal relationships. As the patient was extremely young, and taking into consideration the predictability and longevity of traditional restorative treatments, for this study a more conservative esthetic treatment was chosen with this clinical case. This consisted of using enamel microabrasion techniques with 6% hydrochloric acid and in-office dental bleaching, using 35% hydrogen peroxide.

Dental prophylaxis was performed to remove biofilm. After this, the operative field was isolated with a rubber dam. The aim was to protect the gingival tissues while enamel abrasion was being performed (Fig 2). Special attention was paid to protecting both the patient and professional with the use of protective goggles and individual protective equipment since highly corrosive materials were being used, which are aggressive to human tissues.
After dental prophylaxis, the teeth were isolated with a rubber dam to protect gingival tissues. Note the greater evidence of stains after dehydration of teeth due to isolation of the operating field.

The product was rubbed over the tooth and stained area for 10 s with the aid of a plastic spatula, alternately using a low speed rubber cup for 10 s.

A mild wear was performed on the enamel surface affected by fluorosis using an ultra-fine diamond bur (3195FF, 30 μm; KG Sorensen, São Paulo, Brazil), under water-cooling. Later, a small amount of the material selected for the microabrasion technique was applied on the tooth surface (Whiteness RM; FGM DentsCare, Joinville, SC, Brazil) (Fig 3). This material contains 6% hydrochloric acid and silica carbide in its composition, and it is extremely corrosive. The material was rubbed over the tooth and stained area for 10 s with the aid of a plastic spatula, alternately using a low speed rubber cup for 10 s (Figs 4 and 5). After this the material was removed from the tooth surface with water. The process was repeated eight times on each tooth. Two clinical sessions were performed at intervals of one week (Fig 6). At the end of each consultation, the teeth were polished with paste (ACI and ACII; FGM DentsCare, Joinville, SC,
Brazil) and felt disks. Afterwards, 2% neutral sodium fluoride gel was topically applied for 4 mins, with the purpose of reducing postoperative sensitivity.\textsuperscript{11}

One week after finishing microabrasion, the patient was submitted to dental bleaching with 35% hydrogen peroxide bleaching gel (Whiteness HP Maxx; FGM DentsCare, Joinville, SC, Brazil) due to the yellowish aspect of the teeth. With the aid of a lip retractor, a gingival protective barrier (Topdam; FGM, DentsCare, Joinville, SC, Brazil) was made and the bleaching gel was applied, and submitted to light activation (LED at a wavelength of 450 nm) for 90 s, twice consecutively. The teeth remained in contact with the gel for a total time period of 30 min, before it was removed with an endodontic suction cannula. The teeth were then washed with water. This bleaching process was repeated three times in a single clinical session if the patient did not complain of tooth sensitivity, which was not observed in any of the consultations. A total of three clinical bleaching consultations were performed until the patient was satisfied with the results achieved (Figs 7 and 8).

**Discussion**

Esthetic changes, such as dental fluorosis, which result from intrinsic staining of dental enamel and/or dentin, can be controlled or mitigated by more conservative methods, such as bleaching and/or an enamel microabrasion technique.\textsuperscript{12}

The result obtained by the application of the microabrasion technique should be observed after allowing teeth to go

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**Fig 6** Esthetic result achieved one week after the first microabrasion clinical session. Central incisors with significant improvement, but with quite evident staining in the cervical region of the crown.

**Fig 7** Esthetic result achieved one week after the second microabrasion clinical session. Central incisors do not show perceptible fluorosis stains.

**Fig 8** Final esthetic result of treatment with enamel microabrasion and dental bleaching. This figure shows the final aspect, two weeks after the end of the clinical bleaching sessions, with a high degree of patient satisfaction.
through a period of hydration, because during the clinical stage of treatment, dehydration occurs as a result of the use of absolute isolation. This could lead to both the professional and patient having a mistaken impression of the result achieved. This observation is in agreement with the findings of another study that reported an improvement in the color of teeth submitted to microabrasion after a period of time due to the remineralization of enamel provided by the minerals present in the saliva. In the present clinical case, the results were satisfactory due to an improvement in the appearance of enamel, in which considerable, almost complete stain removal occurred (Fig 7). This brought considerable benefits to the esthetics of the smile and to the patient, resulting in a great change in her interpersonal relationships with her social groups, as well as her family.

The desire for excellence in esthetic dental treatments has led to great scientific and technological advances, and thus more satisfactory results have been found. The microabrasion technique has its space in this context, and although there are several microabrasion techniques described in related literature, products used for this type of treatment are basically composed of an acid associated with an abrasive. Normally, the majority of commercial products developed for enamel microabrasion contain different concentrations of hydrochloric acid. However, since this type of acid is quite corrosive, it has been used at lower concentrations.

In most clinical situations, the microabrasion technique used to remove fluorosis stains is capable of promoting an esthetically satisfying result. However, after treatment, the following effects are expected: some loss of structure, increase in enamel surface roughness and color change of the tooth submitted to microabrasion. Color change after the procedure may occur due to loss of enamel structure (thickness), resulting in a more yellowish result. This setback can be solved by performing an in-office dental bleaching treatment after conclusion of the microabrasion sessions. Another expected effect of enamel microabrasion may be the need to perform a restorative procedure with resin composite, and if this is the case, it will require a longer period of acid etching to obtain a reliable bond to enamel.

With regard to the extension of white spots caused by fluorosis, it is known that the depth of stained enamel cannot be determined before treatment begins. The enamel microabrasion technique can only be considered a definite treatment for teeth with mild or moderate fluorosis. If there is no improvement in color after 12 to 15 applications of the acid, another procedure must be chosen such as, for example, dental wear with burs and resin composite restoration. Therefore, professionals who use this technique must be always aware of possible failures. This must be explained to the patient before starting esthetic treatment with the microabrasion technique. However, in favor of this technique, fluorosis stains are usually confined to the enamel surface layer, which allows microabrasion to remove these stains efficiently.

In the present case report, eight applications of the abrasive material for a period of 10 s were performed on each tooth in each clinical session. Final suc-
cess was obtained after three microabrasion sessions. Thus, as observed in this case report, a combination of treatment methods such as microabrasion and dental bleaching, for example, play a relevant role when esthetic excellence with maximum tissue preservation is desired.\textsuperscript{20,21}

Conclusion

The microabrasion technique with 6% hydrochloric acid associated with silica carbide was shown to be a safe and efficient method for the removal of fluorosis stains, while dental bleaching was useful for obtaining a uniform tooth shade. The association of these techniques presented excellent results and the patient was satisfied; both techniques preserved the dental structure, and were painless, fast and easy for the professional to perform.

References