

Conservative techniques for treatment of dental fluorosis: clinical case report

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Abstract: Fluoride is a very important element in preventing tooth decay, but fluoride intake exceeding recommended amounts can cause acute/chronic intoxication or fluorosis. Dental fluorosis is a consequence of excessive fluoride intake during the development of teeth (especially during the first three years of life) and reflects more commonly in the permanent dentition. The objective of the present study was to review the literature and present a clinical case in which clinical solutions for the rehabil-

itation of patients with fluorosis stains were applied by means of microabrasion and dental bleaching techniques, with aesthetic results satisfactory for the patient. Fluorosis treatment in the reported case was carried out in two sessions of microabrasion of dental enamel, using a paste composed by the same proportions of 37% phosphoric acid (Condac 37, FGM[®]) and pumice stone (Pedra Pomes Extra fina, Maquira[®]). After a one-month interval, an office whitening session was performed (35% hydrogen peroxide, To-

tal Bleach Office H 35%, DFL[®]) associated with home whitening (Total Blanc Home C 16%, DFL[®]). The microabrasion and bleaching techniques proved to be efficient, within the reported clinical case, in the reduction and removal of dental staining caused by moderate fluorosis of the patient, besides favoring the aesthetics of the smile and being able to contribute to the improvement of the self-esteem and social life. **Keywords:** Fluorosis, dental. Enamel microabrasion. Tooth bleaching.

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How to cite: Fontes NM, Pessoa T, Martins ME. Conservative techniques for treatment of dental fluorosis: clinical case report. J Clin Dent Res. 2017 Oct-Dec;14(4):48-57.

Submitted: March 02, 2017

Revised and accepted: November 22, 2017.

DOI: <https://doi.org/10.14436/2447-911x.14.4.048-057.oar>

» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

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INTRODUCTION

With advances in Esthetic Dentistry, patients increase, more and more, their level of demand, looking for a perfect harmony between form, texture, alignment and, especially, tooth color.¹⁴

In several oral epidemiological surveys carried out in the Family Health Strategies, tooth decay is still the most common public health problem in the country. As a result of these surveys, the collective actions of oral health adopt the use of fluoride as a way to control the decay.⁷

Fluoride is a very important element in combating dental caries; however, fluoride intake above the recommended quantity can cause acute or chronic intoxication. Dental fluorosis is a consequence of excess fluoride intake during the chronic form of tooth development, regardless of the source.¹ The highest risk of fluorosis from fluoride intake is during the first three years of life.¹¹

Fluorosis is more common in the permanent dentition than in primary. This may be due to the greater thickness of the enamel of permanent teeth, in addition to greater contact with fluoride during post-uterine life. Clinically, fluorosis has symmetry in the homologous teeth surfaces.³⁵ Furthermore, the classic aspect of fluorosis is characterized by opacity bands that follow the incremental enamel lines.¹⁹ Esthetic problems, such as malocclusion and dental hypoplasia, are more perceived by parents as unsatisfactory than dental fluorosis.²² There is still a lack of information for the population about the wise use of fluoride. Parents know the benefit of fluoride, but do not know its sources and its possible adverse effects, such as dental fluorosis. Many believe that swallowing toothpaste is good for the child and that the ideal is put a lot of amount on the brush.²¹ In contrast, there are many par-

ents and professionals using and recommending the use of non-fluoridated toothpaste, precisely fearing dental fluorosis. It is noted that most people do not know how to define fluorosis and its etiology. Thus, there is a need to disseminate knowledge to the population about dental fluorosis.¹⁵ The purpose of this study is to make a literature review and present a clinical case in which some solutions were applied for the rehabilitation of a patient with fluorosis stains.

PROPOSITION

The objective of this study was to make a literature review and present a clinical case in which some clinical solutions were applied for the rehabilitation of patients with fluorosis stains, using microabrasion and dental whitening techniques microabrasion, aiming satisfactory results for the patient.

LITERATURE REVIEW

Etiology of fluorosis

The teeth are formed by mineralized structures composed by a type of cell that differentiates itself to have its formation. The epithelial cells responsible for tooth enamel formation are the ameloblasts and, clinically, enamel defects can be quantitative (hypoplasia) or qualitative (hypomaturation or hypomineralization).²⁶ Environmental factors may be responsible for structural enamel defects. A classic example is dental fluorosis, due to excess fluoride intake. The fluorosis is characterized by the appearance of whitish spots and a brittle enamel, which can be damaged. The severity of the disease depends on the amount of fluoride ingested.^{18,20}

Dean's index for the registration of dental fluorosis in epidemiological studies is the most used and recommended by the World Health

Organization. It is based on variations in the esthetic appearance of the enamel, ranging from normal/questionable to severe form, covering six categories (0- 5). By presenting fewer categories, it reduces subjectivity and makes clinical examination easier and faster.³ Epidemiological studies conducted in the 1990s indicate that the prevalence of fluorosis ranges from 2.2% to above 90%. In general, high prevalences are present where there are natural sources of water with high fluoride content, such as in China, Africa, Saudi Arabia, United States, Canada, Brazil and Colombia.⁵ In 2005, in the National Study of Prevalence of Oral Diseases, held in Lisbon, with children aged 6, 12 and 15 years (with a sample of 3,710 children in these age groups), most of them had no fluorosis stains. The application of Dean's index to the 6, 12 and 15 age groups identified that the percentage of "doubtful" cases was 7%, 14% and 13%, and in "light" and "very slight" grades, it was 4%, 7.2% and 6%, respectively. "Moderate" grade fluorosis was found in 1% of each age group, and the "intense" one, between 0.1% to 0.2%.⁹ The appearance of these spots on the dental surface can lead to an esthetic commitment that has negative repercussions on the social activities of individuals.^{6,14}

Historic

In an attempt to promote an improvement in the clinical aspect and, thus, offer a favorable esthetics to the patient, since the 30s, several techniques have been proposed.¹⁴ In 1937, the first report of the technique for the removal of fluorosis stains with the use of hydrogen peroxide and heat was given, considering that this method was superior to any prosthetic-restorative treatment for the time.⁴ In 1966, a technique combining hydrogen peroxide (30%),

hydrochloric acid (36%) and ethylene ether, applied on the stains for 15 to 30 minutes, followed by washing and polishing, was described. The results were satisfactory: the patients did not complain of pain and the amount of enamel removed was barely noticeable.²⁴

In 1986, the removal of enamel stains was accomplished by the use of a mixture of 18% hydrochloric acid with pumice, which was applied to the affected area with the aid of a wooden spatula. Thus, by the combined chemical action of the acidic solution with the abrasive effect of pumice, the most superficial layer of the enamel was removed, restoring to its color. Subsequently, several authors obtained clinical success using this technique.^{17,23} Despite the clinical success, it was verified that the concentration of the acid until then used was high, which could cause injuries to the patients and/or professionals. Materials and techniques were, then, developed with other less toxic agents, with lower concentrations, clinically and tested promising very satisfactory results.³²

In polarized light microscopy, it was found that the use of only 18% hydrochloric acid promoted a 47-wear - 100 pm, and that the association with pumice increased this wear to 130-360 µm. The provided by 37% phosphoric acid or even by bleaching agents, such as hydrogen peroxide, is around 1.5 to 5.5 µm, in contrast to the previous values.³⁶ Although there really was wear, it was minimal compared to the total thickness of enamel on the tooth. The enamel is in addition to polished, less prone to demineralization and colonization *S. mutans* when fluoride is applied after the microabrasion. Under scanning electron microscope, healthy teeth submitted to microabrasion have a smoother surface than before this procedure.³³

The microabrasion technique using a batter composed of 37% phosphoric acid with pumice promotes satisfactory clinical results, besides being a more available substance in the dental offices.^{25,33,39}

Available Treatments

The literature refers to several therapeutic approaches for the esthetic treatment of this type of defects. The most invasive techniques involve wear of dental structure and restoration with resin composite laminates and metal-ceramic or ceramic crowns. These operative procedures are recommended when fluorosis is severe. In cases of mild to moderate fluorosis, the treatments are more conservative and go through tooth whitening, microabrasion and composite restoration.^{29,31,38} Alterations in morphology and color of the teeth are often limited to the most superficial layer of the enamel, and are easily solved with the microabrasion technique. This technique, which works both chemically and mechanically, uses an association of an acid with an abrasive substance. The most commonly used acids are hydrochloric and phosphoric, the latter having been applied in lower concentrations and with isolation from the operative field due to its high caustic power.^{25,34,40}

Nowadays, with the improvement of adhesive systems and composite resins, it is possible to make direct restorations with excellent resistance and esthetics. Furthermore, it is possible to preserve the tooth structure by means of infiltration techniques of composite resins or minimally invasive cavity preparations, when techniques such as microabrasion and tooth whitening do not show satisfactory results.^{16,27} However, with the advancement of technology and modern dentistry, there is

a conservative view regarding tooth wear and minimally invasive restorations. This resulted the enamel infiltrating, developed at Charité University of Berlin, Germany.^{10,13,37}

It consists of a substance that has been designed for the treatment of non-cavitated carious lesions located on proximal surfaces. In the case of white spots (fluorosis or trauma), the interesting aspect of the infiltrating agent is the optical properties of the refraction point, since the normal enamel must have a refractive index of 1.62. However, when presenting with fluorosis or traumatic staining, the refractive index drops to 1.33 or 1.0 - thus being a more porous enamel. This difference in refractive index causes the light to be scattered within the lesion volume and explains the whitish aspect of the lesions. The purpose of infiltrating enamel in esthetic areas is to fill the microporosities of the hypomineralized enamel, whose refractive index will return closer to that of healthy enamel (IR = 1.52) in order to mask the defect of the enamel, preserving the tissue denture!^{6,12,37}

Although infiltrating appears to be the most conservative and minimally invasive alternative, it has its limitations, particularly in relation to enamel thickness achieved by fluorosis. In order for this stain to be properly masked and satisfactory results are obtained, the white spot lesion can not be present in more than 1/3 of the tooth enamel of the patient.³⁷

CASE REPORT

A 18-year-old female, normosystemic patient attended the dental care with the main complaint of white spots on teeth, which compromised her well-being. The case for publication was submitted to the Internal Ethics Committee of Ceará School of Dentistry (protocol # 0910/2016).

Figure 1 shows the initial appearance of the patient with hypoplastic enamel spots along the tooth axis, involving the entire dental extension from premolar to premolar, both upper and lower. The patient's aesthetic complaint was whitish tooth staining, with no known cause (Fig 1).

The method employed for treatment of dental fluorosis in this patient was performed in two sessions of microabrasion in dental enamel, always taking care to maintain an adequate thickness of healthy enamel, using a paste formed with equal proportions of 37% phosphoric acid (Condac 37% MGF) and pumice (extra fine pumice, Maquira), as shown in Figure 2. This paste was applied for 15 seconds with a rubber cup, frictionally, then rinsed for 30 seconds, this procedure being repeated three times in each tooth (Fig 3). The same procedure was repeated after 30 days, and, at the end of every 30 days, three microabrasion sessions were performed. Thirty The same procedure was repeated after 30 days, and, at the end of every 30 days, three microabrasion sessions were performed. Thirty days after the microabra-

sion, a 35% hydrogen peroxide (Total Blanc Office H 35% Whitening, DFL) bleaching session was performed (Fig. 5 and 6), as indicated for vital teeth whitening, in the office: two applications of 20 minutes, without activating light (Fig 6).

Then, home bleaching was associated with a 16% carbamide peroxide-based whitening gel (Total Whitening Dental Blanc Home C16% DFL). The patient was instructed to make use of a syringe, for 2 to 4 hours per day, until finishing, applying only the amount necessary to cover the teeth in the tray, avoiding excess material. If there was excess material, this should be expelled, and not swallowed; one drop per tooth is usually enough to cover the entire vestibular surface (Fig 7). After the sessions of microabrasion and office bleaching, neutral fluoride gel, 2% sodium fluoride (Fig. 8) (fluoride gel Flugel, Nova DFL), was applied for 4 minutes).

After the treatment, the patient was very pleased with the esthetic result obtained (Fig 9 and 10), which was reflecting satisfactorily in her personal life.

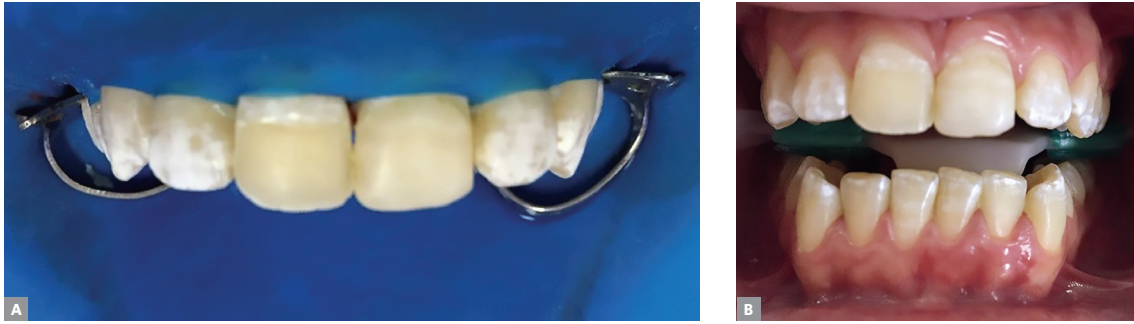


Figure 1: A) Initial aspect of fluorosis patient with isolated operating field. B) Initial aspect of the patient fluorosis.



Figure 2: Showing the proportions of phosphoric acid and pumice for use in paste in microabrasion.



Figure 3: Application of pumice paste and 37% phosphoric acid.



Figure 4: Appearance after completing the sessions of microabrasion and before the bleaching.



Figure 5: Whitener Total Blanc Office H 35% (DFL).



Figure 6: Application of the whitening office agent.



Figure 7: A) Whitening Dental Total Blanc Home C 16% (DFL) and B) acetate board for home whitening.



Figure 8: 2% Sodium fluoride (Fluoride gel Flugel, Nova DFL).

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Figure 9: Final appearance of the patient after completing associated whitening home/office.



Figure 10: Initial and final appearance of the patient.

DISCUSSION

To minimize the amount of fluoride intake from toothpaste, brushing by children under the age of six should be supervised. Parents should take responsibility for putting the dentifrice in the brush, with amount equivalent to a grain of raw rice. In addition, children should be encouraged to spit and rinse your mouth after brushing. Thus, the ingestion of toothpaste by children should be constantly monitored.^{19,28}

The main complaint of the patient reported here and his father was the stained appearance of the teeth; on clinical examination, the diagnosis of dental fluorosis was confirmed, grade TF = 4 This grade has marked opacity on the smooth surfaces, with focal loss in the external enamel less than 2mm in diameter and marked opacity or white chalk appearance throughout the enamel surface.^{3,5} In this case, a conservative treatment of mild fluorosis was chosen using enamel microabrasion and tooth whitening, as many authors initially opted for less invasive measures in an attempt to obtain satisfactory results.^{28,38}

Enamel microabrasion can be used in combination with tooth whitening techniques to effectively treat discoloration and weaknesses in the enamel mineralization. This sequence removes residual stains after microabrasion; It can also be used to treat moderate fluorosis and to restore the smile.^{29,38}

Invasive measures, such as composite resin restorations, laminated veneers and crowns are alternatives for treatment of severe fluorosis or in cases where the microabrasion associated with bleaching did not obtain aesthetically satisfactory results. The therapeutic choice depends on the severity of dental fluorosis, i.e. the clinical aspect.^{2,29,31,38}

In the present study, the chosen technique was the microabrasion of enamel associated with tooth whitening, due to both the clinical aspect of dental fluorosis and the conservative aspect of both techniques. The microabrasion is perhaps the most reliable method for removing stains from dental fluorosis. Moreover, spots due to moderate fluorosis can be removed by this technique, although staining of recurrence is not uncommon in such cases.^{2,31} The microabrasion is a conservative esthetic treatment for fluorosis, as it a superficial removal of the enamel, with the action of an erosive agent (phosphoric acid) and other abrasive (pumice). Thus, it exposes the enamel with normal characteristics and improves the esthetic appearance.^{34,40} Before the application of the microabrasive paste (composed of acid + pumice stone), the complete insulation with a rubber sheet should be performed.^{29,30,38} Some authors have shown that an alternative to this procedure is the use of photoactivated gingival barrier and that both options have the same effectiveness to protect the periodontal tissues.³⁹ Microscopically, the abrasion can be explained by the action of the rotating device associated with an abrasive acid-based compound. A microscopic amount of fluorotic enamel is removed, exposing the subsurface layer of sound enamel. The literature cites an average of 10 to 15 seconds per tooth for application of rotating instrument and to succeed with microabrasion. Thus, the enamel loss is insignificant and clinically unrecognizable, making safe method to be performed.³⁹ At the end of each session, the polishing should be performed with fluoride toothpaste and 2% neutral sodium fluoride applied for 4 minutes. Thus, new smoothness and brightness will be conferred to the enamel, resulting from the removal of enamel minerals and the abrasive particles compacted on the tooth surface.³⁴ In the case of the pres-

ent patient, as in addition to dental stains, after performing microabrasion, the patient still complained of tooth yellowing; other alternative treatments were chosen to improve the esthetic appearance of teeth with severe fluorosis, associating an approach combination of enamel microabrasion and tooth whitening, as a form of minimally invasive treatment. This treatment is also affordable and easy for the patient.³⁹

Currently, there are several reasons for microabrasion as safe, effective, conservative and esthetic. After all, other less conservative options, such as veneers and crowns, involve the preparation and tooth wear 30. However, in this study, the clinical case was handled with microabrasion technique which proved efficient after three sessions, and tooth whitening, which is effective after an office bleaching session associated with a syringe home bleaching. Although the patient has TF = 4 degree in the upper teeth, the esthetic results were clinically satisfactory, with remarkable whitening of the affected tooth surfaces and removal fluorotic enamel with loss of focal structure. The discoloration and erosion of tooth enamel can be esthetically unpleasant and can cause psychological problems.²

The enamel infiltrate could be an alternative for treatment of the patient; however, the product is not easy to find on the market and, moreover, as the patient of fluorosis prevailed

in more than 1/3 the thickness of the enamel, it might not be the treatment of choice for the present case. Although infiltrating appears to be the most conservative and minimally invasive alternative, it has its limitations, particularly in relation to enamel thickness reached by fluorosis.^{6,10,12,13,37}

In this study, after enamel microabrasion treatment, the patient and his father were already satisfied. However, they complained of the the yellowish coloration of the teeth. Thus, it was decided to hold the whitening supervised by a dentist, for the better control of the technique. After doing so, they were satisfied with the results. The most conservative esthetic treatment brings considerable benefits to the esthetics of the smile and the patient, resulting in a major change in relationships with family and social groups.^{6,29}

CONCLUSION

The techniques of microabrasion and enamel whitening have proven effective in reducing and removing tooth staining caused by moderate fluorosis of the patient. The correct diagnosis and the correct choice of the type of treatment can improve the esthetics of the smile and contribute to the self-esteem and social life of our patients. The combination of the treatments showed immediate esthetic results and excellent acceptance by the patient.

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