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Management of moderate fluorosis : A conservative approach

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Abstract

Introduction:
Dental aesthetics play a critical role in self-esteem and social interactions, with dental dyschromias, particularly fluorosis, being common concerns. Fluorosis manifests in varying severity, requiring tailored therapeutic approaches that respect the principle of minimal intervention. This report discusses a case of moderate dental fluorosis managed using a minimally invasive protocol.

Observation:
An 18-year-old female presented with symmetrical yellow-brown stains affecting the vestibular surfaces of her maxillary anterior teeth. Clinical examination confirmed moderate fluorosis (Dean's classification, score 3). Prophylactic cleaning excluded extrinsic causes, and tooth mapping alongside transillumination guided a personalized treatment plan. The adopted protocol combined microabrasion, ambulatory bleaching, and erosion-infiltration. Three microabrasion sessions with Opalustre paste (6.6% HCl) effectively reduced the discoloration. Ambulatory bleaching using 16% carbamide peroxide further enhanced enamel brightness. Residual white spots were treated with Icon's erosion-infiltration technique, achieving excellent optical integration. The minimally invasive approach ensured optimal aesthetic results with no postoperative complications.

Discussion:
Fluorosis results from excessive fluoride exposure during amelogenesis, leading to enamel hypomineralization and porosity. The described protocol exemplifies a conservative treatment strategy that effectively restores dental aesthetics while preserving healthy tissue.

Conclusion:
This case demonstrates the success of a personalized, minimally invasive approach in managing moderate dental fluorosis. The protocol serves as a model for addressing similar cases, balancing aesthetics, functionality, and tissue preservation.

Keywords:
Dental fluorosis, microabrasion, erosion-infiltration, minimally invasive dentistry, enamel hypomineralization.

Introduction :

Dental aesthetics now occupy a central place, profoundly influencing self-esteem and social life. Among the most frequent concerns are dental dyschromias, particularly those linked to fluorosis, regardless of their severity.

These dyschromias have been the subject of numerous studies aimed at clarifying their aetiology, clinical characteristics and the treatment options appropriate to each situation.

Treatment must respect the therapeutic gradient from the least invasive to the most invasive approach, while taking account of tissue sacrifices and possible post-operative complications. It depends, on the one hand, on the patient's wishes and, on the other hand, on the type of dyschromia, as well as its extent and depth [10].

This paper presents a clinical case to explore the diagnostic and therapeutic approaches to moderate fluorosis, with a focus on evaluating and comparing the various treatment options available.

Observations :

An 18-year-old female patient in good general condition presented to the Department of Dentistry at EPS Farhat Hached in Sousse, concerned about the unsightly appearance of stains on the vestibular surfaces of her maxillary anterior teeth. (Fig.1)

The patient reported being originally from Gafsa and mentioned that her older brother exhibited similar stains.

Prophylactic cleaning beforehand enabled the extent of the dyschromia to be better visualised and a possible extrinsic aetiology to be ruled out. The clinical examination carried out after drying and in good light revealed the presence of :

- Yellow/brown staining, symmetrical and bilateral, affecting all maxillary teeth.

- These stains mainly affect the middle third and the third of the enamel surface of the affected teeth.

- The lower teeth are creamy-white in colour and pale in appearance. (Fig.1)

Figure 1: Preoperative clinical view

Figure 2: Initial Tooth mapping

The data gathered from the history-taking and clinical examination (Fig. 2) confirmed the diagnosis of moderate dental fluorosis, corresponding to a score of 3 based on Dean's classification (Table I).

So, the treatment adopted consisted of a micro-invasive approach combining micro-abrasion with ambulatory bleaching and infliration-erosion of recurrent white spots.

After placement of the sectorial dental dam, three microabrasion sessions were performed, each session consisting of eight microabrasion cycles of 10 seconds each, using Opalustre paste (Ultradent) and a special Opalcup mounted on a contra-angle handpiece with a speed of 500 rpm (Fig. 3).

At the end of each session, fluorotherapy was performed by applying Flor-Opal (Ultradent) fluoride gel for 5 minutes to prevent postoperative sensitivity. Simultaneously, a home bleaching treatment was prescribed, involving the application of 16% carbamide peroxide for 3 hours daily over a two-week period (Fig.5). Finally, a session of Erosion infiltration was carried out to treat the residual white spots.

At the end of the third microabrasion session, the yellow-brown spots had been completely corrected, but two white spots remained on the incisal thirds of teeth 11 and 21 (Figs. 4, 6 and 7). Secondary tooth-mapping was done to better delineate these lesions (Fig.8), and erosion-infiltration was performed using Icon (DGM):

- Erosion using the Icon-Etch for 2 minutes
- Dehydration using Icon-Dry for 10 seconds
- Application of the 1st layer of Icon-Infiltrant for 3 minutes and light-curing for 40 seconds
- Apply the 2nd layer of Icon-Infiltrant for 3 minutes and light-cure for 40 seconds. (Fig.9)

At the end of the treatment, the teeth had regained their even shade and normal translucency. (Fig.10)

Figure 2: Placement of a sectorial dam and application of Opalustre microabrasion paste

Figure 3: Clinical view at the end of the 1st microbrasion session.

Figure 4 : Making a dental splint for ambulatory bleaching.

Figure 5: Clinical view at the end of the 2nd microbrasion session.

Figure 6: Clinical view at the end of the 3rd microbrasion session.

Figure 7: Secondary Tooth mapping

Figure 8: Placement of a sectorial dam and implementation of erosion-infiltration with Icon (DMG).

Figure 9: Immediate post-operative clinical view

Discussion

Aetiology of Dental Fluorosis

Fluoride retention in the body is linked to the properties of apatite, the main mineral component of teeth. While the incorporation of fluoride into bone is reversible due to constant remodelling, its incorporation into tooth enamel is definitive and occurs during tooth formation and after eruption. Excessive ingestion of fluoride, especially during amelogenesis, can lead to dental fluorosis, which is defined as damage to hard dental tissue as a result of fluoride intoxication. It is manifested by hypomineralisation or porosity of the enamel. This condition results from excessive exposure to fluoride during amelogenesis, mainly observed in regions where drinking water contains more than 4 ppm of fluoride. During the dental development phase, fluorides are incorporated into dental tissue, while after eruption, an additional contribution comes from the oral environment. [8, 11]

High fluoride concentrations appear to influence the activity of ameloblasts during the late secretion phase and the early maturation phase of teeth, resulting in insufficient calcification of the enamel matrix [9]. The complete development of hydroxyapatite crystals is disrupted by excess fluoride, leading to porous fluorotic tissue, capable of incorporating any coloured

exogenous element, resulting in variable secondary staining of the teeth (chalky white, brown) associated or not with loss of substances and influenced by the dose, duration and period of exposure and individual susceptibility. [6, 18,21]

In this case, until the age of 8 (corresponding to the period of maximum susceptibility), the patient consumed tap water from her region, known for its high fluoride concentration. This exposure was exacerbated by daily consumption of tea made from the same water.

Description of dental fluorosis

Dental fluorosis is characterised by symmetrical enamel opacities following the lines of enamel development, resulting from altered mineralisation [4]. Topographically, these opacities may appear as isolated or confluent white lines, or as more extensive patches, giving the tooth a parchment-like appearance [4]. In extreme cases of hypomineralisation, the enamel may be completely opaque [5].

Histologically, there is hypomineralisation of the enamel, with enlarged interprismatic spaces, giving the enamel increased porosity. This porosity explains the secondary dyschromias, where exogenous pigments penetrate the enamel, transforming white opacities into brown [1]. In addition, the reduction in enamel hardness encourages post-eruptive loss of substance in the form of pits [7, 17].

Several classifications have been proposed by authors; however, this work adopts Dean's classification due to its clinical relevance. (Table I).

Using this classification, the clinical examination for dental fluorosis involves assessing both arches to first confirm the presence of fluorotic lesions :

- If the diagnosis is confirmed, the fluorosis score is based on the two teeth most affected.

- If these teeth do not show the same degree of affection, then the score chosen is that of the least affected tooth.(Table I)

Table I: Clinical description of dental fluorosis levels according to the DEAN index [14].

Index	Clinical criteria	Score
Normal	-The enamel is normally translucent. - The surface is smooth, shiny and pale creamy white.	0
Questionable	-Lesions take the form of fine, irregular white, opaque lines or spots on the incisal third of the upper incisors.	1
Very Mild	-Small opaque white areas irregularly distributed over the surface of the tooth. -These spots are mainly found on the vestibular surfaces and occupy 25% of the surface of the affected tooth.	2
Mild	-The opaque areas occupy at least half of the tooth surface. -Slight brown spots are sometimes visible.	3

Moderate	- All tooth surfaces are affected. -Change in tooth shape. Prominent attrition surfaces. - Brown stains and pits on vestibular surfaces.	4
Severe	-Hypoplasia is prominent and sometimes affects the shape of the tooth. -The pits are deep and confluent, leading to loss of surface enamel and giving the tooth a corroded appearance. -The spots are brown or even black in colour.	5

Diagnostic approach

A precise diagnosis of dental fluorosis requires a detailed clinical examination and targeted investigations. The practitioner must ascertain the patient's expectations regarding their smile and the desired result. By observing the teeth, first wet then dry, it is possible to assess the fluorosis score, the nature and extent of dyschromia and any loss of substance [20].

The depth and thickness of opacities, although difficult to determine accurately, can be estimated by transillumination using an LED light on the palatal or lingual surface of the tooth. Sharp contours indicate superficial enamel opacity, while blurred contours indicate deep opacity as it does not allow light to pass through, and vice versa. A darker colour reflects a thicker opacity.

Tooth mapping completes the assessment by mapping lesions on clinical photographs, making it possible to objectify the contours, proportions and colours of opacities.This method guides analysis and treatment planning while limiting bias [13].It can be repeated at each stage to assess results and adjust the treatment plan. (Diagram 1)

Diagram 1: Initial and secondary Tooth mapping

<u>Therapeutic approach</u> (diagram 2 and 3)

In the light of histopathological data and optical characteristics, the treatment of enamel white spots consists of either restoring hypomineralised enamel, camouflaging the lesion optically or removing it mechanically.

Preventing fluorosis remains the best approach. The aim is to control fluoride intake, particularly in children under the age of 6 (at risk) and living in endemic areas. When these

preventive strategies cannot be implemented or fail, several treatments ranging from enamel micro-abrasion and bleaching to direct or indirect restorations can then be applied [2, 16] according to the 'therapeutic spectrum', from the most conservative to the most mutilating (Fig. 11) [12].

The therapeutic approach is therefore personalised according to the fluorosis score. The aim must be to ensure maximum tissue preservation. This rule is even more rigorously applied in young patients and when the dental hard tissues concerned are exempt from any other pathology, as in the present case, which is why we have opted for the least invasive approach, i.e. a combination of micro-abrasion, erosion-infltration and ambulatory bleaching. [12]

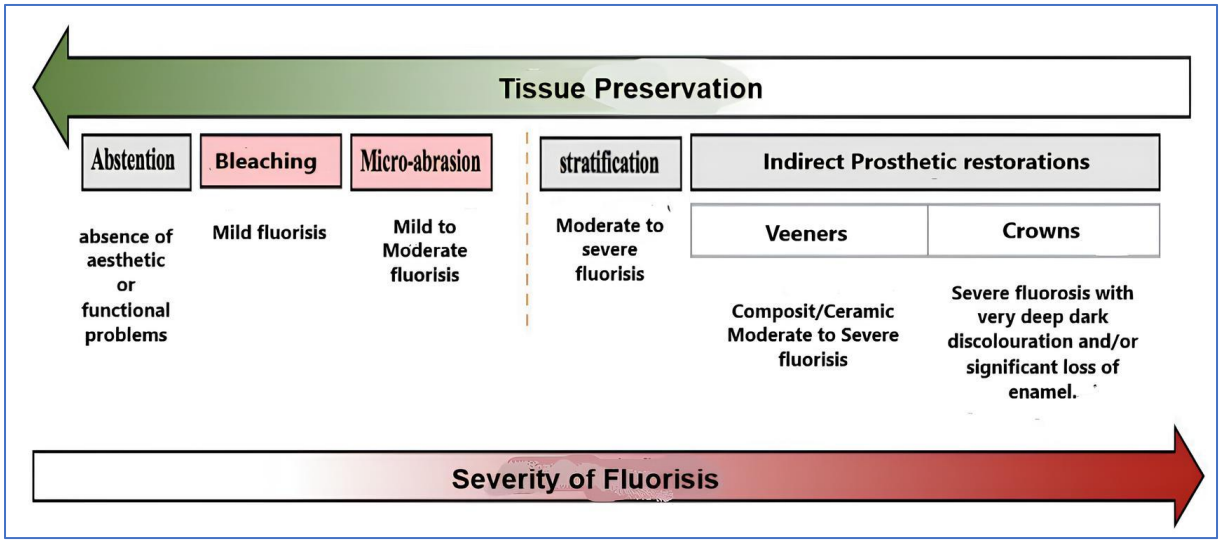

Figure 11: The therapeutic scale according to the severity of fluorosis [17]

Indeed, micro-abrasion is a chemo-mechanical treatment practised since 1986 to remove opaque white and brown stains from enamel in a controlled manner (up to 200 µm deep), while smoothing the surface irregularities of enamel thus providing a more regular and shinier surface [3, 19] by abrasion effect.

Opalustre, used in the case presented, contains 6.6% HCl, which etches the enamel surface, and abrasive silicon carbide particles for mechanical enamel reduction. It is suitable for correcting enamel discolouration to a depth of 0.2 mm (ALLEN et al. 2004).

Before applying Opalustre, the manufacturer recommends polishing the surfaces concerned for 5 to 10 seconds. In this way, the mild hydrochloric acid contained in the paste and the silicon carbide particles can better penetrate the tooth structure.

External bleaching, on the other hand, results in a lighter, more homogenous tooth structure, as was the case with our patient. The loss of a thin layer of enamel can allow the underlying dentine to show through. Bleaching makes it possible to reduce the saturation of the shade in addition to obtaining a more uniform shade of the tooth. It therefore reduces the contrast between the stain and the tooth by increasing the overall brightness of the latter. [12]

Furthermore, although 'erosion-infiltration' therapy was initially developed for the treatment of non-cavitating carious lesions, it also has other interests, particularly optical, allowing its use to be extended to the aesthetic treatment of enamel white stains due to fluorosis.

The purpose of infiltration is to modify the optical properties of the lesion so that its luminosity matches that of the tooth. Although this treatment is ingenious, it first requires the lesion to be exposed by chemical or mechanical means, which are more or less invasive. [14]

This technique consists, after treating the enamel surface with an acid (Icon-etch) creating micro-reliefs within the enamel, in impregnating by capillary action the anfractuosities of a non-cavity lesion with a very low viscosity light-curing hydrophobic composite resin called infiltrant (Icon-infiltrant).

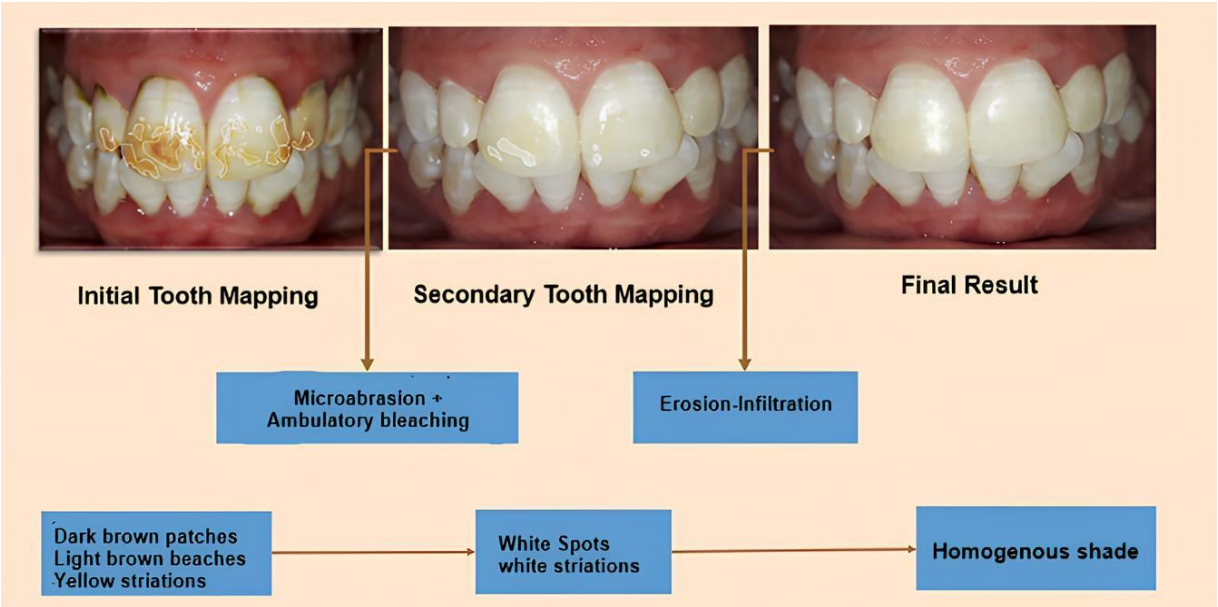

Diagram 2: Appropriate diagnostic and therapeutic approach

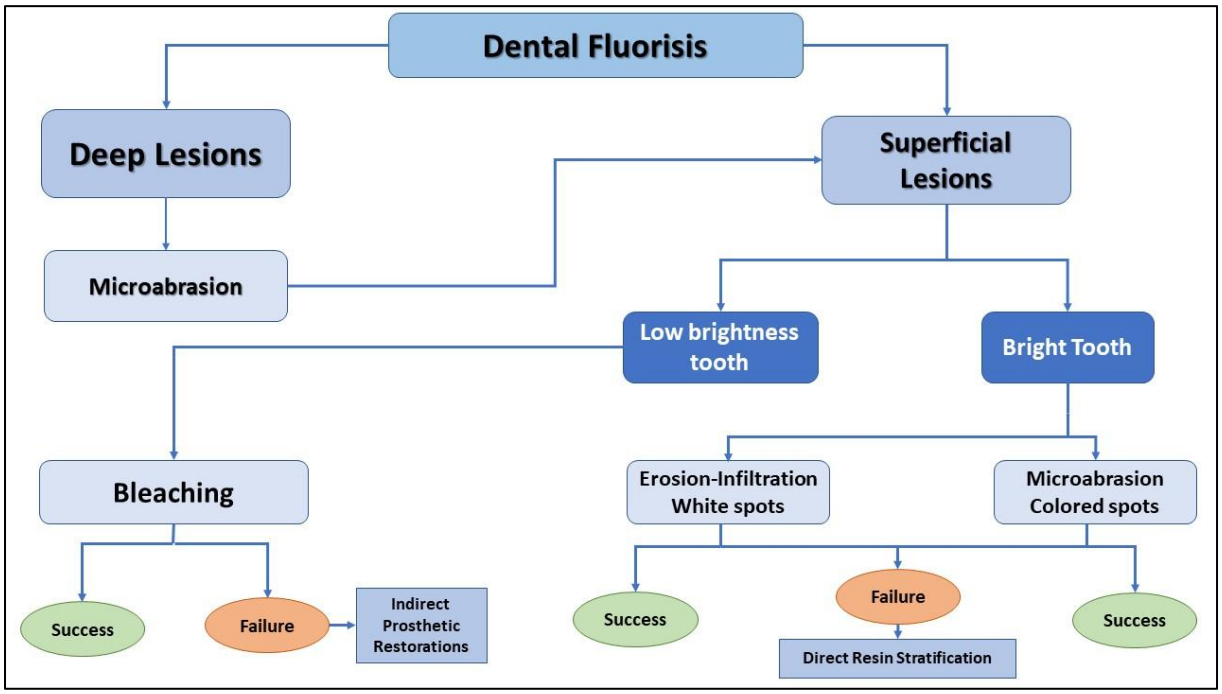

Diagram 3: Decision-making diagram

Conclusion

Dental fluorosis represents a major clinical challenge due to its aesthetic and psychosocial impact.The minimally invasive approach presented in this case combines microabrasion, ambulatory bleaching and erosion-infiltration, offering both a conservative and effective solution.

This protocol could serve as a model for the management of other cases of moderate fluorosis, underlining the importance of a personalised strategy tailored to the severity of the fluorosis.

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