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Case Report

Combined in-office and at-home bleaching of vital teeth in an adolescent patient-
A case reportSharbari Dutta^{1*}, Gayatri Palla², Brahmananda Dutta³, Abinash Mohapatra³¹Dept. of Health Research, International Institute of Health Management Research, New Delhi, India²JCMR - National Institute of Nutrition, Secunderabad, Telangana, India³Kalinga Institute of Dental Sciences (KIDS), Bhubaneswar, Odisha, India

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ABSTRACT

Fluorosis is one of the prevalent causes of discoloration of tooth. Tooth discolouration is a common aesthetic issue which can be caused by various factors, categorized into either extrinsic or intrinsic. Numerous recent advancements are available to manage tooth discoloration effectively. This case report demonstrates a remarkable aesthetic improvement of fluorosed tooth achieved through in-office bleaching, highlighting the procedure's efficacy in restoring a brighter smile.

A twelve-year-old patient with mild to moderate dental fluorosis underwent a conservative treatment to address fluorosis, prioritizing cost-effectiveness and minimal invasiveness. After 3 visits for vital in-office bleaching and at home bleaching showed considerable lowering of intensity of the discolouration. The combined in-office and at-home bleaching approach successfully improved the dental profile, meeting both the patient's and parents' aesthetic and practical goals. Studies generally favour in-office bleaching over home bleach methods for longevity and efficacy, though sensitivity levels vary by concentration and desensitizers. For optimal results, professionals are advised to follow manufacturer protocols, maintain the concentration of the bleaching agent, and application time, and combine in-office and at-home treatments for safe, and lasting whitening.

In this case, patient was advised to avoid stain-causing foods and maintain good oral hygiene post-treatment, to prevent re-staining and maintain the tooth shade. This case also highlighted the effective management of fluorosis in children.

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1. Introduction

Patients with dental fluorosis typically have a history of prolonged excessive fluoride intake during the crucial period of enamel formation, from birth to approximately eight years of age. The severity of dental fluorosis varies widely, ranging from subtle white opaque spots that are less noticeable to more prominent pitting and discoloration of the enamel, which can result in dark yellow brown discolorations as well.¹

While fluoride is essential for bone and tooth health, as it combines with calcium to form hydroxyapatite and strengthens calcified tissues, excessive intake over time can lead to dental fluorosis, skeletal fluorosis, and even reduced intelligence in children. High rates of dental fluorosis among adolescents are a growing concern, particularly due to the potential psychological impact. Discoloured and porous enamel can be aesthetically unsatisfactory, negatively affecting a child's self-esteem and social interactions.²

The World Health Organization (WHO) has set the maximum fluoride concentration in drinking water at 1.5 mg/L to prevent fluorosis. In 2008-09, National Program

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for Prevention and Control of Fluorosis (NPPCF) was initiated by India in response to that. This program identifies areas with elevated fluoride levels, manages water sources, and screens schools and communities for fluorosis. It encompasses comprehensive case management, ensuring drinking water quality meet standards, and improving children's nutrition to mitigate fluorosis effects.³

For children with dental fluorosis, there are several cosmetic treatments available. To restore the natural white appearance of enamel, tooth can be bleached, whitened, and micro-abrasion or macro-abrasion can remove subsurface porosities and extrinsic stains. When porosities are too deep for micro-abrasion without causing sensitivity or altering tooth shape, veneering the enamel surface with porcelain or resin composite can enhance aesthetics.⁴ In young children and adolescents less invasive procedures like bleaching is generally the preferred choice of treatment.

The aesthetic appeal of a smile is of great importance. Tooth whitening, or bleaching is a popular non-invasive aesthetic procedure, first began for non-vital teeth in 1848 with chloride of lime.⁵ Later, in 1864, Truman introduced a highly effective method for bleaching non-vital teeth, which involved releasing chlorine from a mixture of calcium hypochlorite and acetic acid.⁶ Bleaching is frequently used to fully or partially restore discoloured teeth. It has always been and is the most popular aesthetic technique, due to its low cost, non-invasive nature, and conservative approach.⁷

The history of vital tooth bleaching dates to 1868 with the introduction of oxalic acid, followed by using Pyrozone in 1892. In 1911, hydrogen peroxide became the standard bleaching agent in dental clinics, often activated by heat or light. In the 1960s, Dr. Bill Klusmier pioneered a successful at-home bleaching method using Gly-Oxide, a 10% carbamide peroxide oral antiseptic, administered with a custom-fitted mouth tray. This method improved both gingival health and tooth color. Subsequently, Gly-Oxide was replaced by Proxigel, a 10% carbamide peroxide formulation with a slower release, specifically designed for orthodontic patients. This modification enhanced both the effectiveness and convenience of the bleaching process.⁸

Tooth bleaching can be divided into three main types: internal or nonvital, external or vital, and at-home bleaching. Internal bleaching process places the bleaching agent inside the tooth that has undergone endodontic treatment, either through direct application by a dentist or the "walking bleach" technique, where the bleaching agent is placed in the tooth and left between appointments.³ External bleaching, involves applying the bleaching agent on the enamel surface of a tooth with healthy pulp, and includes at-home bleaching, in-office bleaching, and over-the-counter products. At-home bleaching involves the patient using custom-fitted custom-fitted trays either provided by a dentist or over the counter products the counter products like tooth whitening pastes which vary in strength and

effectiveness compared to professional treatments.⁹ The success of these methods depends on the ability of the bleaching agents, usually peroxides, to penetrate the enamel and dentin, breaking down stains and whitening the teeth.

Stains can also be classified into extrinsic and intrinsic stains. Extrinsic stains occur on external tooth surface due to the accumulation of chromogenic substances from consumption of stain-causing foods and drinks, or tobacco use and poor oral hygiene. These stains are primarily localized in the pellicle either because of reactions between sugars and amino acids or due to the retention of external chromophores. Intrinsic stains are typically due to internal discoloration or defects in the enamel caused by aging, consumption of stain-inducing foods and beverages, tobacco use, enamel microcracks, tetracycline antibiotics, high fluoride intake, severe jaundice in infancy, porphyria, dental decay, restorations, and the natural thinning of the enamel layer.⁸ Fluorosis is a very common public health problem in India especially in certain belts like in Orissa, Karnataka to name a few where adolescent school goers show considerable dental staining due to ingested fluorides through food and drinking water.¹⁰

In-office bleaching is a type of vital bleaching technique utilizing hydrogen peroxide, in varying concentrations often enhanced with agents like titanium dioxide activated by light or heat for a period of 15-30 minutes.¹¹ Hydrogen peroxide may be mixed with titanium dioxide or nitrogen-doped titanium dioxide to act as a photocatalyst, activated by a specialized light or laser for faster results.¹²

2. Case Report

A twelve-year-old male patient was referred to the Department of Pedodontics and Preventive Dentistry in Kalinga Institute of Dental Sciences with the complaint of discoloration of teeth. His clinical history was recorded, intra-oral examination was done for caries,¹³ and other findings and a diagnosis of fluorosis was reached. On intra-oral examination noticeable brown/yellow staining of his teeth was observed. Mild to moderate fluorosis staining was diagnosed on the anterior and posterior teeth based on Dean's Fluorosis Index. His parents desired for the least invasive and cost-effective management of the condition. Thus, it was decided instead of other aesthetic treatments available like veneers, in-office vital bleaching would be done. Clinical photographs were taken before starting of the procedure. (Figures 1 and 2) For this patient, 35% hydrogen peroxide, Maxx white Office® was selected as the bleaching agent. (Figure 3) In-office bleaching is a clinically safe and effective whitening procedure to enhance the whitening effect using hydrogen peroxide concentrations, typically between 30% and 35%, helping in reducing sensitivity.¹⁴ A liquid dam was applied as a barrier and cured for gingival protection. (Figure 4) Bleaching agent and powder were mixed in equal parts and the homogenous, thick mix

prepared was applied uniformly on the tooth surfaces using an applicator tip and left for 20 minutes. (Figure 5) Then the homogenous mix was washed off using air-water syringe. This process was repeated again during the same visit. Post operative photographs were recorded (Figure 6).

An impression was recorded of the upper and lower jaw for fabrication of custom-made trays for application of home bleach using elastomeric putty. (Figure 7) Custom made trays (Figure 8) were prepared and given to the patient for loading home bleach (Figure 9) and to be applied once a day for 10 days. Patient was recalled for second (Figures 10 and 11) and third visits (Figures 12 and 13) after a period of 1 month each and the same steps were repeated. Post operative photographs were recorded after each visit. White mottled enamel hypo-mineralisation with the most significant staining were visible on the maxillary anterior teeth especially tooth nos. 11 and 21 had dark brown streaks in the middle third of the facial surfaces at the beginning of the treatment which was found to significantly reduced by the third visit.



Figure 1: Intra oral view of upper and lower arch during first visit



Figure 2: Intra oral anterior view

3. Discussion

Office bleaching, which utilizes high concentrations of hydrogen peroxide, is a highly effective method for enhancing tooth shade, capable of improving it by up to four grades. This effectiveness is notably increased with the use of photoactivation methods that enhance the bleaching outcome.¹⁵ Despite its efficacy, the procedure presents certain challenges. Office bleaching can reduce enamel



Figure 3: Office bleach /Professional bleach used for the two appointments



Figure 4: Application of gingival barrier to prevent gingival trauma or irritation



Figure 5: Etching the tooth surfaces with severe fluorosis



Figure 6: Post bleaching after first appointment

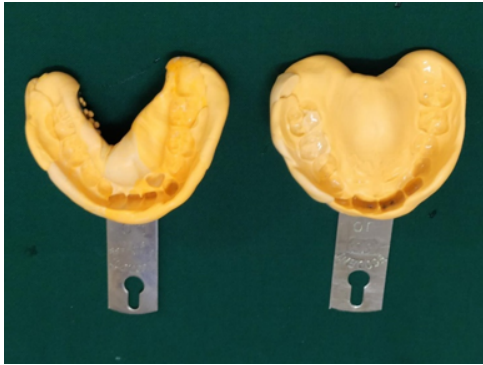


Figure 7: Impression recorded for fabrication of custom-made trays for application of home bleach



Figure 8: Custom tray prepared for loading of the home bleach



Figure 9: Home bleach kit



Figure 10: Intra Oral view of upper and lower arches after second appointment conducted after first month



Figure 11: Intra Oral anterior view after second appointment conducted after first month



Figure 12: Intra oral view of upper and lower arches after third appointment conducted after the second month.



Figure 13: Intra oral anterior view after third appointment conducted after the second month.

bonding performance due to changes in enamel porosity, even following phosphoric acid etching.¹⁶ Additionally, it may cause temporary dehydration of the enamel, creating a misleading whitening effect until the enamel rehydrates, which necessitates final colour assessments to be conducted after a week.¹⁷ Comparative studies, particularly those using split-mouth designs, indicate that office bleaching generally surpasses home methods in both whitening effectiveness and longevity.¹⁸ However, it often results in moderate tooth sensitivity immediately after treatment due to the rapid penetration of hydrogen peroxide, potentially leading to inflammatory reactions in the tooth. Sensitivity levels reported across studies vary; some suggest higher sensitivity with in-office treatments, while others find greater sensitivity with home techniques.¹⁹ These differences are frequently attributed to variations in agent concentrations and whether desensitizing components are included to maximize the benefits of bleaching while minimizing risks, it is recommended that professionals adhere to manufacturer protocols, carefully balance hydrogen peroxide concentration with application duration, and consider a combination of in-office and at-home treatments for sustained, lower-risk whitening. This combined approach, coupled with individualized treatment plans that protect soft tissues and consider patient-specific factors such as sensitivity and enamel thickness, ensures that the whitening benefits of office bleaching are achieved without compromising enamel health.²⁰

In aesthetic rehabilitation, the goal is to enhance the patient's appearance and boost self-confidence while preserving tooth structure as much as possible. Treatment plans for enamel hypo-mineralization can vary widely based on the severity of the defect, with conservative approaches typically involving interventions like tooth bleaching, enamel macro-abrasion, micro-abrasion, and resin infiltration.²¹ A recent clinical report recommends treating enamel fluorosis stains with at-home bleaching using a 10% carbamide peroxide gel in an overnight tray as the initial step, followed by resin infiltration to conceal residual white spots.²² In contrast, in this case, in-office bleaching was chosen to ensure compliance, as the patient's likelihood of wearing an overnight tray was uncertain. Additionally, in-office bleaching did not lead to sensitivity in this case.²³

In preparation for in-office bleaching, the dentist first examines the teeth to ensure there are no caries, gingival complications, or other dental concerns that could complicate the procedure. Once confirmed, a protective barrier, typically a gel or rubber shield, is applied to the gingiva to shield them from the bleaching agent following which a high concentration of hydrogen peroxide or carbamide peroxide is applied directly to the teeth, where it penetrates the enamel to target discoloured areas within. Some in-office treatments also incorporate a specialized

light or laser, which can activate or accelerate the bleaching process, intensifying the whitening effect which was not done in this case. This step is optional and varies depending on the system used by the dentist. The bleaching agent is generally left on the teeth for 15-30 minutes before being rinsed off. This process is often repeated multiple times in a single session to achieve the desired level of whiteness. While significant results are often visible after one session, additional appointments may occasionally be recommended for optimal results.^{23,24}

In-office bleaching offers several advantages that make it a popular choice for treatment of fluorosis and those seeking immediate and effective tooth whitening. One of the key benefits is the speed of results; in-office treatments often deliver noticeable whitening after just one visit, lightening teeth by several shades within a short time. Another advantage that can be listed here is the extent of customization possible. It is a cost-effective, non-invasive, and conservative procedure.

4. Conclusion

Dentists can customize the concentration of the bleaching agent and adjust the number of applications to meet each patient's needs, ensuring a balance between whitening effectiveness and sensitivity. Professional supervision enhances the safety of the procedure, as in-office bleaching occurs in a controlled environment. This reduces the risk of gingival irritation or enamel damage, and the dentist can make real-time adjustments if discomfort arises.⁸ The combination of immediate results, personalized treatment, and safety makes in-office bleaching a reliable choice. It is essential to follow post-treatment care instructions to maintain the results, such as avoiding stain-causing foods and drinks like coffee, tea, and tobacco for 24-48 hours, and practicing good oral hygiene through regular brushing, flossing, and cleanings.²⁵ This patient was followed up for 3 months and visible changes were observed in this case through vital bleaching procedure.

5. Conflict of Interest

None.

6. Source of Funding


None.


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