

CLINICAL CASE

Bleaching treatment of devital tooth with color changes after trauma: a 2-years follow-up

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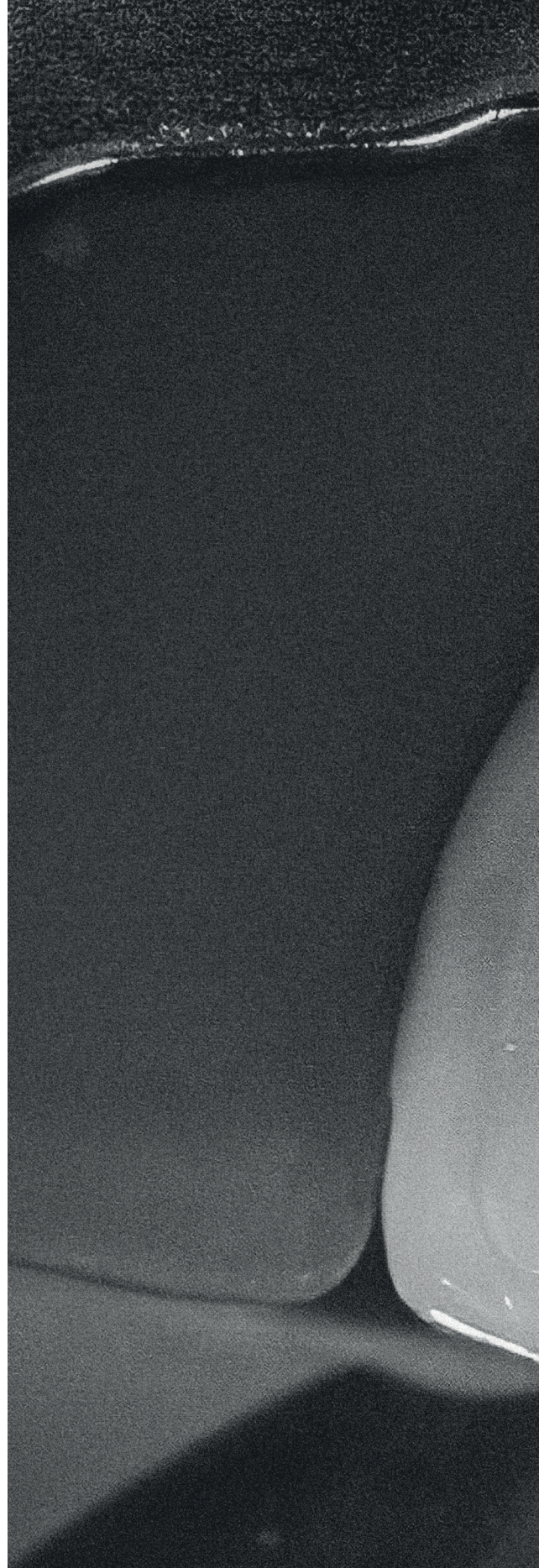
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ABSTRACT: The question of esthetics is a major concern in dentistry today. The color of the teeth is an important factor, since the color harmony is perceived quickly. The single discoloured tooth can be a challenge in obtaining an aesthetic outcome in the anterior region. This case report describes the treatment of a single darkened tooth by combining internal and external bleaching techniques. It is also reported the clinical and radiographic follow-up in which a slight yellowing of the endodontically treated tooth was observed after 2 years. Also described is external bleaching treatment for maintenance of tooth whitening after color recurrence through a 35% hydrogen peroxide whitening session which was sufficient to restore smile harmony. In this clinical case, the whitening treatment provided good aesthetic results.

KEYWORDS: Bleaching Agents. Endodontics. Tooth bleaching.

INTRODUCTION

The single discolored tooth can be a challenge in obtaining an esthetic outcome in the anterior region.¹ The advantages of internal bleaching have been well reported in the literature.² Conservation of tooth structure³ and achievement of good aesthetics is possible while the procedure is an important option in aesthetic treatment.⁴

Dental bleaching can be done through external or internal bleaching. For vital bleaching technique, bleaching gels based on hydrogen peroxide or carbamide peroxide are applied directly on the enamel surface.^{5,6} In contact with the teeth, these components release active principles that diffuse through the enamel and dentin and oxidize the pigments responsible for discoloration.⁷ In the technique of internal bleaching, exclusive for non-vital teeth, the sodium perborate mixed with distilled water is sealed inside the pulp chamber.⁸ The internal bleaching agent releases active oxygen into the pulp chamber, which diffuses through the dentinal tubules and oxidizes the pigments present in dentinal tubules.⁹

Complete colour matching of the bleached tooth with the adjacent teeth is regarded as an optimal result.² But whenever non-vital tooth bleaching is performed, there is always a concern that relapse occurs and tooth discoloration returns.¹¹ That is caused presumably by diffusion of staining substances and penetration of bacteria through marginal gap between the fillings and the tooth.¹⁰

It is therefore necessary that dental practitioners understand the etiology of tooth discoloration to arrive at a correct diagnosis leading to an appropriate treatment plan.¹² In addition, it is important that the dental surgeon perform clinical and radiographic follow-up after the bleaching treatment to identify possible color relapses and then perform the appropriate bleaching treatment for restore the harmony of smile color. Based on this, the present case report aims to describe the diagnosis and treatment of endodontically treated teeth with color alteration through the association of internal and external bleaching techniques and a 2-year follow-up.

CASE REPORT:

A 26-year-old man sought treatment with the aesthetic complaint of tooth 21 (Fig. 1). The element 21 was darker compared to the other teeth. The color of the teeth was determined using a color scale (VITA Clas-

sical, VITA, Bad Säckingen, Germany). Tooth 21 had the color A3.5 while all the other teeth were B1 (Fig. 2). The patient was asked about the possible cause of the color change of the tooth 21 and reported that after a dental trauma during sports practice 15 years ago was noticed the progressive darkening of tooth.



Figure 1: Clinical appearance of the smile before treatment.



Figure 2: Color evaluation with shade guide. The color was recorded as B1 for all teeth and A3.5 for the tooth 21.

In the radiographic examination, we observed obliteration of the pulp canal spaces in tooth 21, and the pulp vitality test with ice was negative for this tooth. For all other teeth, no changes were found in the radiograph (Fig. 3A). In the clinical examination, an intrinsic discoloration caused by pulpal hemorrhaging following traumatic injury was diagnosed. After diag-

nosis of the cause of the spotting, a treatment plan involving a combined approach of internal and external bleaching was elaborated.

Endodontic treatment of tooth 21 was performed (Fig. 3B), and after one week, an internal bleaching procedure was started. The technique chosen for

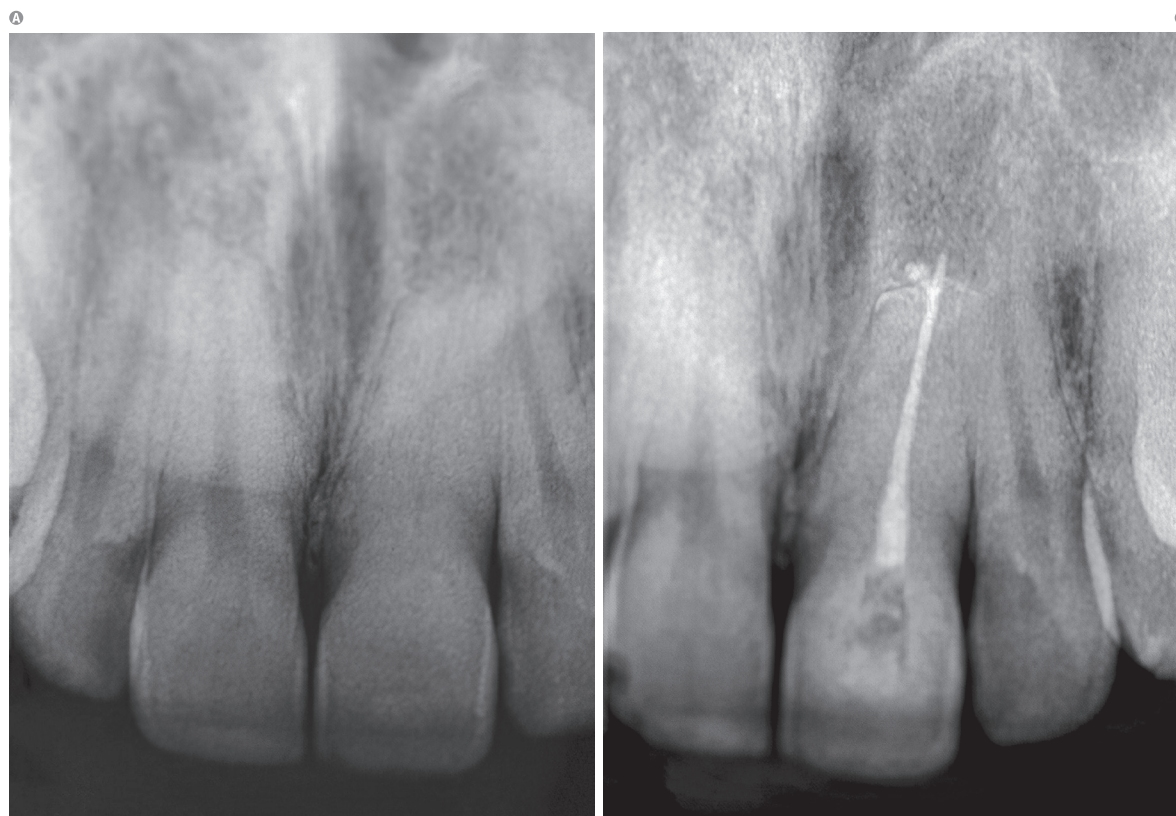


Figure 3: **A)** Radiograph of the traumatized tooth before the root canal treatment was performed; **B)** Radiograph of the tooth after the root canal treatment.

internal bleaching was walking bleaching. After the absolute isolation of the operative field with rubber dam, access to the pulp and complete removal of all restorative and obturator material present in the pulp chamber, cervical sealing was performed.¹⁰ The cervical sealing should be made 1-2 mm below the cement enamel junction (CEJ).¹⁰ To remove filling material up to this level, Gates-glidden or Largo burs were used⁷ (Figs. 4A - C). After this, a 2mm layer of a

zinc-oxide-based material (Coltosol, Coltene, Bon-sucesso, Rio de Janeiro, Brazil) was inserted into the root canal¹³. The intracoronal level of the barrier was placed 1mm incisal to the corresponding external probing of the attachment at the mesial, distal, and labial aspect of the tooth. On top of the zinc-oxide-based material was inserted a cotton ball moistened with water for 5 minutes until the material expansion and root seal.

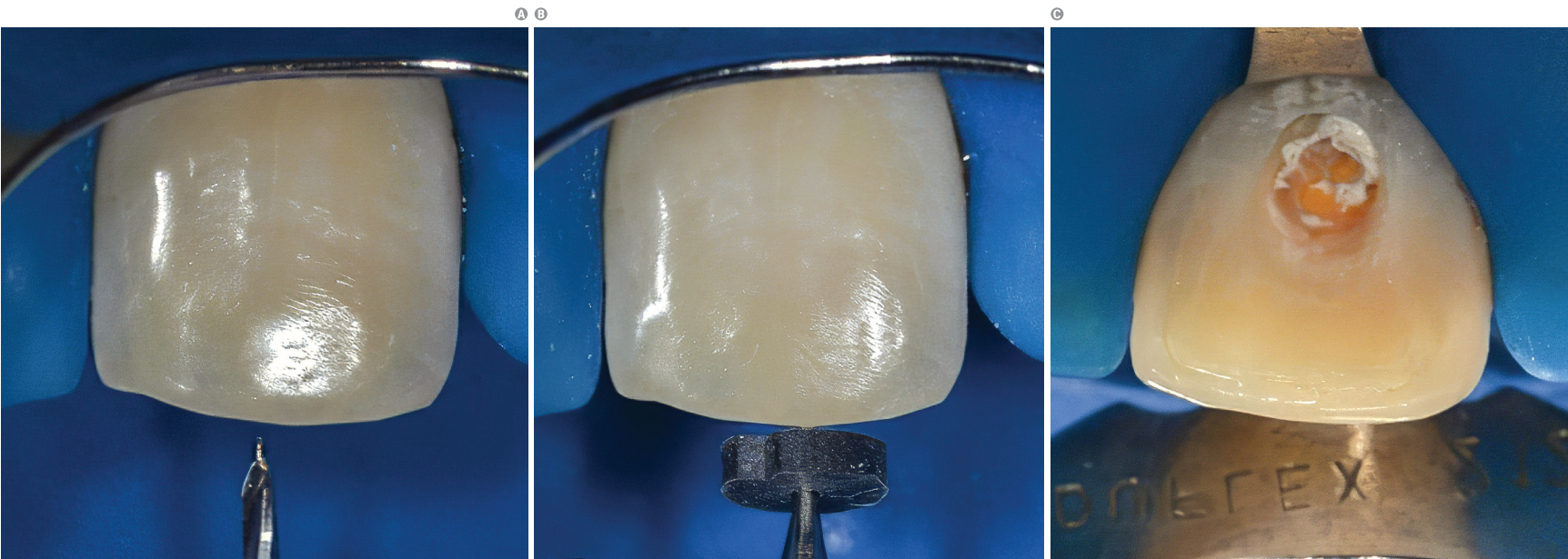


Figure 4: (A) Start of desobturation with Largo burs; (B) Desobturation up to the established measure; (C) Removal of filling material.

After this, sodium perborate tetrahydrate¹⁴ was mixed with distilled water in a ratio of 2:1 (g/ml).¹⁰ The bleaching agent was inserted into the pulp chamber, and a thin layer of cotton was placed thereon (Fig. 5). Then the cavity was restored temporarily using a zinc-oxide-

based material.¹⁵ The bleaching agent was changed into four sessions with a 4-day interval between them. At each session involving the bleaching agent exchange, it was possible to see the progression of color change caused by the internal bleaching (Figs. 6A - D).

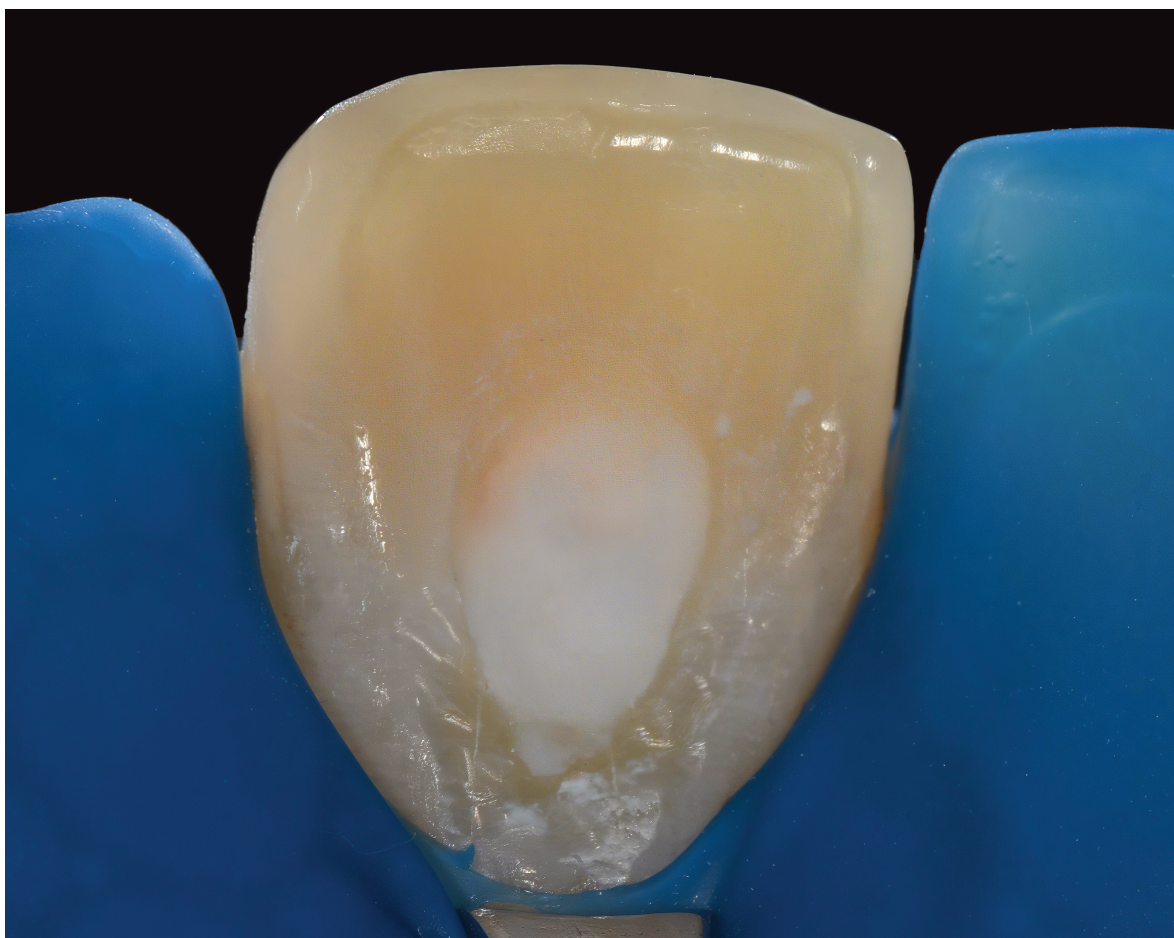


Figure 5: Paste of perborate sodium mixed with distilled water in a ratio of 2: 1 (g/ml) inserts into the pulp cavity.



Figure 6: Clinical appearance of the teeth in the bleaching agent exchange session: **A)** First exchange; **B)** Second exchange; **C)** Third exchange; **D)** Fourth exchange.

External tooth bleaching was performed after the internal bleaching had been completed. A bleaching gel based on hydrogen peroxide 35% (Whiteness HP 35%, FGM, Joinville, Santa Catarina, Brazil) was mixed according to the manufacturer's recommendation and applied to the buccal surfaces

of the upper and lower anterior teeth (Fig. 7). After the gel's application, it was kept in contact with the dental surface for 15 min. Every 15 minutes during the 45-minute session, the bleaching gel was changed. After one week, the in-office bleaching treatment was performed again.



Figure 7: External bleaching.

On tooth 21, after the second external bleaching session, a slurry of calcium hydroxide mixed with distilled water in a ratio of 2:1 (g/ml) was inserted into the pulp chamber for pH neutralization.¹⁶ The cavity was again restored provisionally with the zinc-oxide-based material (Coltosol, Coltene, Bonsucesso, Rio de Janeiro, Brazil), and after 14 days, the final restoration was done with a nanohybrid composite resin (Empress Direct, Ivoclar-Vivadent, Barueri, São Paulo, Brazil).

Fourteen days after the last bleaching session, the final color analysis was performed using the color scale (Fig. 8). The tooth 21 presented the color B1, which was compatible with the color of all the other teeth. In the end, the patient presented a harmony regarding the color of his teeth (Fig. 9).

After two years, the bleaching treatment was followed up. The radiographic analysis demonstrated

Figure 8: Color evaluation with shade guide. The color was recorded as B1 for all teeth.



Figure 9: Clinical appearance after internal and external bleaching.





normal state of the bone and periodontal tissues (Fig. 10). In the clinical analysis, it was possible to identify a subtle disharmony in relation to the color of the teeth. Tooth 21 showed a slight regression of color, appearing more yellowish than the other teeth. When using the shade guide, it was determined that tooth 21 presented with the color B2 while the other teeth presented with the color B1 (Fig. 11). The patient was asked about his satisfaction regarding the color of the teeth. He was satisfied with the result after two years, but he was uncomfortable with the color change. In-office bleaching was then proposed to the patient.

Figure 10: Radiographic evaluation after 2 years.

Figure 11: Color evaluation after 2 years with shade guide. The color was recorded as B1 for all teeth and B2 for the tooth 21.



A bleaching gel based on hydrogen peroxide 35% (Whitess HP 35%, FGM, Joinville, Santa Catarina, Brazil) was mixed according to the manufacturer's recommendations and was applied to the buccal surfaces of tooth 21 (Fig. 12). Three gel applications were performed for 15 minutes, totaling 45 minutes of application. After 7 days, a new bleaching session was performed in the same manner as described above.

As a result, we can see in Figure 13 that the external bleaching using hydrogen peroxide at 35% was effective in maintaining internal bleaching after two years. Tooth 21 presented with the color B1, which was compatible with the color of the other teeth. The patient and the dentist were satisfied with the whitening achieved.



Figure 12: In-office bleaching.



Figure 13: Color evaluation with shade guide. The color was recorded as B1 for all teeth.

DISCUSSION:

Dental trauma is a common cause of tooth discoloration. The traumatic injury can cause hemorrhaging in the pulp chamber caused by rupture of blood vessels. The blood cells undergo hemolysis and release iron, which reacts with hydrogen sulfide, a metabolic byproduct of bacteria, to form iron sulfide, which causes the gray staining of the tooth.¹⁷

There are several bleaching techniques available for single discolored teeth. The decision is mainly based on the vitality of the tooth and whether the treatment should be performed in-office or at home or a combination of both¹. The treatment of choice for this case report was a combination of internal and external dental whitening techniques. Dental bleaching is a conservative alternative to the more invasive esthetic treatment of non-vital discolored teeth.¹⁸

To begin treatment, after a color evaluation, radiographs and the ice vitality test are additional procedures that must be performed to ensure that endodontic treatment should be made before the bleaching treatment.¹ According to Kwon¹, if the pulp survives a traumatic injury, it can undergo canal obliteration, also referred to as calcific metamorphosis. Calcific metamorphosis is characterized by rapid deposition of hard tissue beginning within the pulp chamber and continuing along the root canal

space, resulting in yellow-to-brown discoloration of the clinical crown.¹ Root canal treatment can help to prevent the development of apical periodontitis in teeth with a progressive obliteration of the pulp canal spaces.¹⁹ The root canal treatment act as a basis for an internal bleaching of the crown²⁰ but not adequately prevent diffusion of bleaching agents from the pulpal chamber to the apical foramen.¹⁹

It has long been suggested that external cervical resorption may be caused by bleaching agents.²¹ Cervical root resorption is an inflammatory-mediated external resorption of the root, which can be seen after trauma and following intracoronary bleaching.¹⁸ Thus, it is imperative that an adequate barrier material be found to prevent leakage of bleaching agents into the apical portion of the root and laterally into the periodontal tissues.¹⁹

A variety of materials have been suggested for making the cervical seal. According to Hosoya et al.¹³, compared to a zinc phosphate cement, zinc oxide materials provide the most favorable seal when they are firmly packed into the cavity space to prevent microleakage. The shape of the cervical seal should be like the external anatomic landmarks, thus reproducing the CEJ position and interproximal bone level.¹⁰

The bleaching agent used for the walking bleaching technique was sodium perborate.¹⁴ Sodium perborate, in contact with distilled water, breaks down into sodium metaborate and hydrogen peroxide. The later finally degrades into water, and free radicals of oxygen thereby allow for the release of the primary oxidizing agent.¹⁵ The use of sodium perborate with distilled water prevents the bleaching agent from entering the periodontal space through the ubiquitous microperforations and therein causing inflammation that can facilitate root resorption.²³ Depending on the severity of the discoloration, successful bleaching becomes apparent after one to four visits.¹⁰ The walking bleach technique may be supplemented with an in-office bleaching.²⁴ External bleaching is also a successful treatment for endodontically treated teeth.²⁵ This treatment can be performed with hydrogen peroxide.⁶

After tooth whitening, the access cavity should be restored with composite resin using an etch-and-rinse adhesive system.¹⁰ During tooth whitening, oxygen free radicals are delivered from the bleaching agents through the enamel and dentin. Thus, oxygen, hydroxyl, or perhydroxyl ions remain trapped in dentinal structures,²⁶ inhibiting the polymerization of composite resin materials.²⁷ As a result, the literature does not indicate the perfor-

mance of adhesive restorative procedures immediately after bleaching.²⁸

A waiting period of 14 days is necessary to perform restorative procedures after internal bleaching.²⁸ During this period, the color of the bleached teeth should be stable, and a calcium hydroxide slurry may be placed in the pulp cavity to neutralize acid pH.²⁹ Calcium hydroxide does not interfere with the bond strength of the restorative material.¹⁶ A nanohybrid composite was selected to restore the patient's lesions due to its excellent mechanical properties and good polishing. A postoperative radiograph after internal bleaching and regular follow up with radiographs are recommended.

Complete colour matching of the bleached tooth with the adjacent teeth is regarded as an optimal result.¹⁰ However, the recurrence rate in bleached endodontically treated teeth is relatively high, and it has not been completely elucidated whether the recurrence of discoloration in bleached teeth is caused by the same substances or by penetration of pigments from the oral cavity.²³ Possible causes of color regression may be associated with: 1- chemical reduction of oxidation products; 2- marginal breakdown of the final restoration; and 3- the inherent permeability of the enamel and dentine to extrinsic pigments.²² Howell et al.,²² reported a

recurrence rate after one year of 53%. A study by Amato et al.⁷ followed up internal bleaching of 35 teeth after 16 years. The results show that 62.9% of the cases presented a stable color similar to the adjacent tooth color and were classified as a success. A total of 37.1% presented color change of two or more color units.

Dentists judge the success of bleaching much more critically than do patients. After a 5-year observation period, 75% of the cases were judged to be successful by the dentist, while 98% of the patients were satisfied with the results.³⁰ In this case report, after 2 years, a small yellowing of the color of the tooth was observed with color change from B1 to B2 according to the shade guide. Despite this, yellowness did not return to baseline within 2 years.

The patient and dentist considered the result satisfactory, but due to the notable color change, in-office bleaching was indicated to restore the smile color harmony. In-office bleaching seems to be appropriate for the patient in some cases, such as severe or single tooth discoloration, lack of compliance, or desire for immediate whitening. In addition, external bleaching is a simple and conservative treatment and does not require some steps that are necessary for internal bleaching.

Internal bleaching is an effective alternative to the treatment of darkened teeth after trauma. Despite a small change in color after two years, the dentist and patient considered the results of the internal bleaching to be satisfactory. The in-office bleaching was effective in maintaining color harmony after two years.

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