Internal Bleaching As An Esthetic Management For Discolored Non-Vital Tooth Post-Endodontic Treatment: Case Report

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ABSTRACT

Background: Dental trauma may lead to pulpal necrosis, resulting in internal degradation of dental tissues and subsequent discoloration of the affected tooth. This discoloration is commonly associated with degradation of pulp remnants, penetration of obturation materials into dentinal tubules, or hemolysis of erythrocytes during endodontic procedures. Internal bleaching offers a minimally invasive and biologically conservative approach for esthetic rehabilitation in these cases.
Objective: To present a clinical case demonstrating the application of internal bleaching using the walking bleach technique for the esthetic management of a non-vital, endodontically treated maxillary central incisor.
Case Report: A 25-year-old female visited RSGM Unpad with a discolored maxillary left central incisor (#21) and worsen her appearance. The patient's previous history of trauma five years ago. Clinical and radiographic examinations confirmed pulp necrosis, with asymptomatic apical periodontitis. Root canal treatment was performed using standar protocol. Two weeks post obturation, internal bleaching was initiated using the walking bleach technique with 35% hydrogen peroxide. The coronal seal was ensured using a 2 mm cervical barrier of resin-modified glass ionomer cement to prevent cervical resorption. After two bleaching sessions, a satisfactory shade match with adjacent teeth was achieved without any complications.
Conclusion: Internal bleaching with the walking bleach technique provides an effective, conservative, and predictable solution for managing discolored in non-vital teeth. The use of a proper cervical barrier and careful case selection are essential to minimize risks. This approach provides favorable esthetic results while preserving tooth structure.

Keywords
Internal bleaching, esthetics, non-vital tooth, tooth discoloration, endodontic.

INTRODUCTION

Tooth discoloration following tooth trauma is a prominent clinical situation, especially in the anterior area, and can considerably impact esthetics as well as the general self-confidence of a patient. Patients generally are prompted by the need for better esthetics to visit a dental clinic. Tooth discoloration can be either extrinsic or intrinsic in nature and can occur in both vital and non-vital teeth. Intrinsic discoloration results from the introduction of chromogenic agents into dentin and enamel during the odontogenic or post-eruption stage. Tetracycline therapy during tooth formation, excessive intake of fluoride, and genetic conditions like amelogenesis imperfecta and dentinogenesis imperfecta are pre-eruptive intrinsic factors. Intrinsic post-eruptive discoloration is mostly caused by pulp necrosis, breakdown products of blood inserted into dentinal tubules after trauma or pulpectomy, and continuous secondary dentin deposition owing to age or iatrogenic factors. Extrinsic discoloration is mostly food and environmental chromogenic substances like coffee, tea, oranges, and tobacco. Trauma can cause pulpal necrosis, intrapulpal hemorrhage, and the resulting hemoglobin breakdown products leading to intrinsic discoloration. Root canal treatment in the majority of these cases will be necessary to address the pulpal necrosis, but there are still esthetic issues because discoloration persists.[1-3]

The treatment of discolored teeth involves the use of full-coverage crowns, veneers, and bleaching therapy. Of these, bleaching is a conservative and non-surgical method as it is capable of regenerating esthetics with natural tooth structure preservation.[4,5] Bleaching can be either internal or external based on the vitality of the tooth. External bleaching is typically recommended for vital teeth with extrinsic discoloration, whereas internal bleaching is the preferred treatment for non-vital teeth with intrinsic staining.[6] Internal bleaching is also assumed to be a conservative and less intrusive esthetic treatment relative to restorative treatments like full-coverage crown or veneers involving significant tooth reduction. Among the bleach modalities, walking bleach with sodium perborate has been a predictable outcome with minimal risk for complications.[7-8]

With correct case selection and proper cervical sealing, internal bleaching is also a predictable outcome with reported long-term success ranging from 80-90% for 10-25 years.[1] This case report demonstrates the esthetic rehabilitation of a traumatised maxillary central incisor with post-endodontic discoloration using the internal bleaching technique, emphasizing clinical protocol, outcome, and long-term perspective for success.

OBJECTIVES

The aim of this article is to introduce a clinical case demonstrating the esthetic rehabilitation of an endodontically treated, non-vital, maxillary central incisor using internal bleaching with the walking bleach technique.

CASE REPORT

A 24-year-old female patient came to the Conservative Dentistry Department of the Dental Hospital, Universitas Padjadjaran with chief complaint of discoloration of dark color of maxillary right central incisor, which is influencing her personality and appearance. History of trauma due to fall eight years before was provided. The patient desires the color of her tooth to be the same as that of the surrounding teeth. The patient was free from systemic disorders and also free from any allergy.

Initial clinical presentation is shown in Figure 1a. Clinical examination showed that the teeth were darker, the tooth was asymptomatic, not swelling or sinus tract palpable. The caries-free or fractured tooth. Cold vitality test showed a negative responses, percussion and palpation test were negative. No tooth mobility or abnormalities in the soft tissue were observed. Periodontal probing depth was normal. As indicated in Figure 1b, radiographic examination revealed widening of the periodontal ligament space in the apical region of tooth 21.

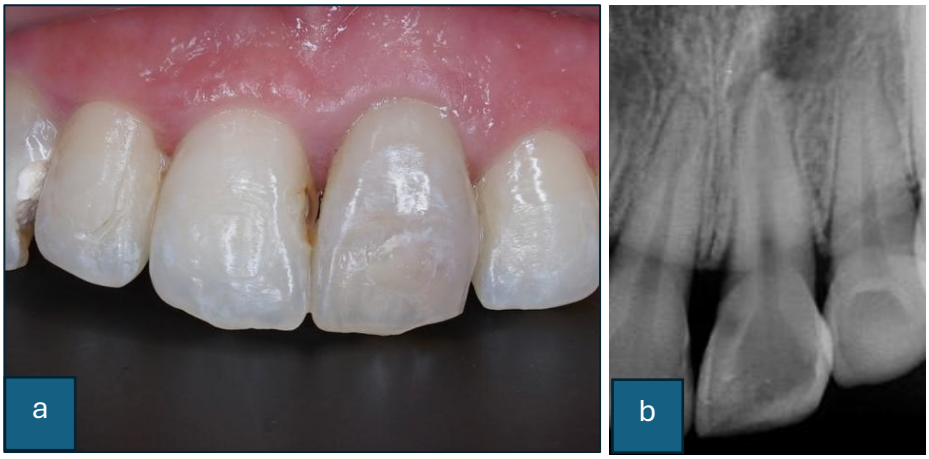

Figure 1 a. Initial clinical appearance, b. Initial radiological appearance.

Based on the patient's symptoms, clinical examination, and radiographic evaluation, tooth 21 was diagnosed as pulp necrosis with asymptomatic apical periodontitis, following the criteria of the American Association of Endodontists (AAE). The recommended treatment was root canal therapy. Prior to treatment, the patient was thoroughly informed about the findings, diagnostic results, treatment options, and possible complications. She demonstrated understanding of her condition and provided informed consent for both the treatment and the use of her case for publication.

Procedures

On the first visit, the patient was educated regarding the status of his teeth, treatment, follow-up, cost and treatment multiple visits and complication that may be incurred. The patient was provided an IEC, DHE, and an informed consent request. Root canal treatment was begun by assessing the original tooth color with the Vitapan Classical shade guide. The treatment was

begun by scaling and polishing in preparing a healthy supporting tissue. Local anesthesia was administered using 2% lidocaine HCl with 1:100,000 epinephrine (Lignospan, Septodont Inc., USA). Isolation was achieved with rubber dam (Sanctuary, Perak, Malaysia) (Figure 2a).

Cavity preparation on tooth 21 was initiated using a diamond round bur to gain initial access, followed by careful removal of carious tissue with an excavator and a carbide round bur. Endodontic access was subsequently refined using an endodontic access bur (Dentsply Maillefer, Switzerland) until the roof of the pulp chamber was completely removed, providing clear visibility of the canal orifices. Canal negotiation was carried out with a #10 K-file (Dentsply Maillefer, Switzerland). Working length was determined using an electric apex locator integrated into the endomotor (TriAuto ZX2, J. Morita, Kyoto, Japan). The working length was found to be 22 mm (Figure 2b). Root canal were cleaned and shaped using the crown-down technique with Rotary Protaper Gold (Dentsply Maillefer, Switzerland). The comprehensive treatment for tooth 21 consisted of root canal treatment, internal bleaching, and restoration of the foramen caecum with composite resin.

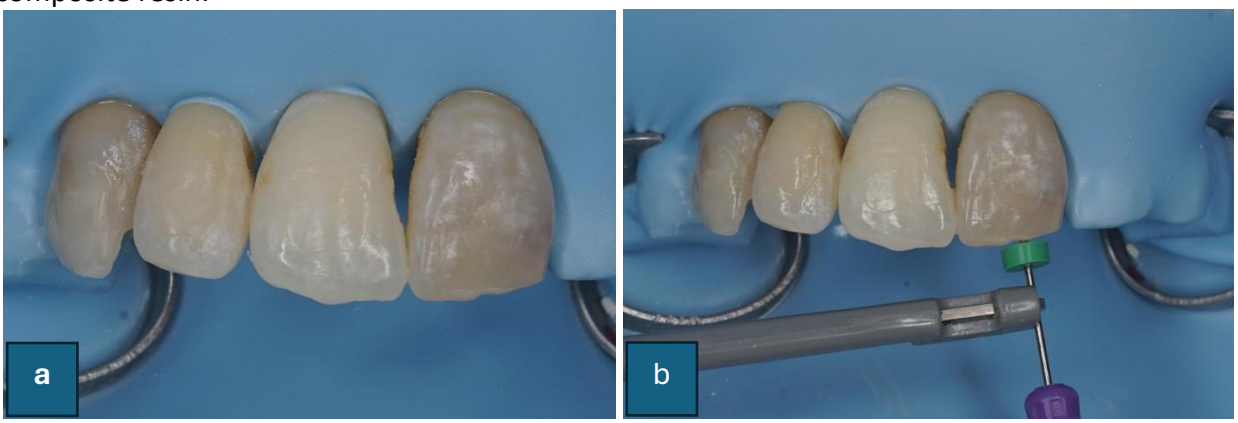

Figure 2. a. Isolation rubber dam, b. Work length measurement

Root canal preparation with Rotary Protaper Gold (Dentsply Maillefer, Switzerland) and master apical file (MAF) F3 on tooth 21 is demonstrated in Figure 3. Irrigation with 5.25% NaOCl at each change and application and use K-File #10 to recapitulate, 17% EDTA and distilled water was performed using a 5 ml syringe with a side-vented 31G needle (Dia-dent, Netherlands). The irrigants were activated using sonic activation of irrigation materials. The canals were dried with endodontic suction and sterile paper points (Meta-Biomed, South Korea). Following canal drying, a calcium hydroxide medicament (Calcipex, Nishika, Japan) was placed into the root canals and

left for two weeks. The access cavity was then sealed with a temporary restorative material (Caviton, GIC Corporation, Japan).

Figure 3. Preparation using Protaper Gold

On the second visit, at the two-week follow-up after the initial placement of the intracanal medicament, the patient reported no subjective symptoms. Clinically, the percussion test was negative. Following examination, local anesthesia was administered to tooth 21 and rubber dam isolation was achieved. The temporary restoration was removed, and the calcium hydroxide medicament was thoroughly cleaned from the canals. Irrigation was performed again using 5.25% NaOCl, 17% EDTA, and distilled water, with subsequent activation of the irrigants. The canal were then dried with paper points, calcium hydroxide medicament was reapplied, and sealed with a temporary restoration (Caviton). The patient was advised to return for further evaluation after two weeks.

On the third visit, after two weeks. The patient reported no symptoms. Following examination, local anasthesia and rubber dam isolation was achieved. The temporary restoraration and calcium hydroxide were removed. Final irrigation was performed with 5.25% NaOCl, 17% EDTA, and distilled water, followed by activation or irrigants. The canals were dried with paper points. A gutta-percha fit test (ProTaper Universal, Dentsply Sirona, Switzerland) was carried out by placing the master cones into canal up to the working length, and the fit was verified radiographically (Figure 4a). Subsequently, a single cone technique with a bioceramic sealer (Ceraseal, Meta Biomed, South Korea), extending up to 2 mm below the canal orifices. The access cavity was then sealed with a temporary restorative material. A post-obturation radiograph was obtained to confirm the adequacy and quality of the root canal filling (Figure 4b).

Figure 4 a. Gutta-percha fit test, b. Root canal filling radiography

On the fourth visit, tooth shade evaluation was performed using a shade guide at the patient's initial presentation. The tooth initial shade was determined using the Vitapan Classical shade guide, recorded as C4 (Figure 5), and an initial photograph was taken as a baseline reference for evaluating the success of bleaching treatment. Comprehensive extraoral and intraoral examinations were performed, revealing no abnormalities. Percussion and bite test were negative, and the temporary filling were in good condition with healthy surrounding gingival tissues. Following rubber dam isolation, the temporary restoration was removed, and gutta-percha was retrieved to a depth of 2 mm below the cementoenamel junction (CEJ) using a heated plugger with stopper. The depth was confirmed with a periodontal probe (Figure 6) and radiographic verification. The cavity was then irrigated with sterile distilled water, dried, and a 2 mm glass ionomer cement (GIC) barrier was placed with a ski slope formation from the proximal side and a bobsled tunnel from the labial side until the radiographic confirmation.

Figure 5. Initial shade guide measurement (C4)

Figure 6. Determining and measuring the depth of the barrier on the labial

After cervical seal dried, internal bleaching was performed by applying 35% hydrogen peroxide (Opalescence Endo, Ultradent Products Inc., South Jordan, UT, USA) into the pulp chamber (Figure 7), which was then covered with a cotton pellet and sealed temporary with GIC. The patient was advised to monitor color changes daily and radiographs were taken to confirm the adequacy of the root canal barrier is shown in Figure 7. The patient was instructed to control 1 week later.

Figure 7. Bleaching material application

Figure 8. Root canal GIC Barrier radiograph

On the fifth visit, after one week. Extraoral and intraoral examinations were unremarkable, with negative percussion and bite test responses, stable temporary filling, and healthy surrounding gingival tissues. Tooth color was re-evaluated using the shade guide (Vitapan Classical), however, the shade did not yet achieve a complete match with the adjacent teeth. Therefore, and additional application of the internal bleaching agent was performed within the pulp chamber, followed by temporary sealing using resin-modified glass ionomer (RMGI). The patient was instructed to return for subsequent follow-up evaluation.

On the sixth visit, after one week. Extraoral and intraoral examination were unremarkable with negative percussion and bite test responses, and the condition of the filling was good and the surrounding gingiva was normal. Objective examination showed that tooth discoloration from C4 to B2 (Vitapan Classical) (Figure 9), which matched the patient's preference and was harmonius with adjacent teeth. After rubber dam placement, the GIC filling was removed, and the cavity was irrigated to eliminate residual bleaching agent before drying. The pulp chamber was rinsed, dried, and calcium hydroxide was placed for 1 week before the placement of the permanent restoration, and temporarily sealed.

Figure 9. At the sixth visit, the tooth shade changed from C4 to B2

On the seventh visit, one week later, extraoral and intraoral examination again showed normal findings, there was no discoloration and maintaining color harmony with the adjacent teeth. The temporary filling was intact and gingival tissues remained healthy. After rubber dam placement, the temporary filling was removed. The pulp chamber was rinsed, dried and restorated with final palatal composite restoration. Phosphoric acid 37% etching was applied to the palatal cavity, followed by rinsing and drying. A bonding agent was placed and light curing, then composite resin was incrementally layered and polymerized. Occlusion and articulation were verified, and finishing and polishing were performed. The patient was advised on oral hygiene maintenance and instructed to avoid foods and beverages that could cause staining.

Figure 10. Composite resin restoration on tooth 21

During eighth visit, extraoral and intraoral examinatios were unremarkable. The restoration remained in good condition with stable tooth color and excellent marginal adaptation. Clinical assessment was performed by comparing the post-treatment tooth shade with its original one before treatment using Vita shade guide and photographs. Before and after treatment clinical photographs are shown in Figure 11.

Figure 11. Before and after treatment

DISCUSSION

Tooth discoloration, especially the anterior teeth, is a very esthetic concern and negatively impacts the looks of an individual. A few modalities can be used for the treatment of this condition, e.g., veneers or full-coverage crown, but these procedures are very invasive. Bleaching method is a non-invasive and conservative process that tries to whiten the tooth color by using oxidizing chemical agents that oxidize the organic pigments in the tooth structure.[9] It is easy to do, inexpensive, and less invasive. There are two primary bleaching procedures: external bleaching, which is carried out for vital teeth and extrinsic stains, and internal bleaching, which is carried out for non-vital teeth and intrinsic stains. In instances of intrinsic discoloration after endodontic treatment, internal bleaching can be obtained by placing the bleaching agents into the pulp chamber. The most used for this process is the walking bleach method.[1,9] In this case, the tooth discoloration in the tooth 21 is caused by intrinsic factors.

Tooth staining can be caused by intrinsic developmental or acquired causes. Developmentally, it can happen in the process of primary or permanent teeth formation when the tooth germs are subjected to chromogenic agents, e.g., tetracycline antibiotics, which are incorporated into the dental tissue. Diet (eating chromogenic foods and drinks), smoking, medication use, and aging are acquired causes. With progressive aging, the pulp chamber becomes narrower due to deposition of secondary dentin or reparative dentin, leading to an excess of tooth shade. Intrinsic discoloration is typically due to pulpal necrosis, trauma, intracanal medicaments, or restorative materials. Discoloration of endodontically treated teeth can be due to deterioration of remaining pulp tissue, blood breakdown products, or extrusion of irrigants and sealer into dentinal tubules.[10]

The majority of authors differentiate between coloring as either extrinsic or intrinsic. Extrinsic discoloration results from accumulated staining agents at the enamel surface, while intrinsic discoloration results from pigments penetrating more internal dental tissues. Extrinsic stains are typically superficial and can be easily removed by prophylaxis under professional care. Deep intrinsic stains may actually be superficial, involving the enamel surface, or deep, involving the dentin. Structural imperfections such as enamel cracks may additionally allow pigment penetration into the tooth substrate.[3,9]

In this case, the discoloration of tooth 21 was due to intrinsic factors associated with pulpal necrosis following trauma. The patient had given a history of a bicycle accident about eight years ago for which no treatment had been received because no symptoms had arisen at that time. The trauma had resulted in intrapulpal hemorrhage and erythrocyte lysis. Blood and its constituents leaked into the dentinal tubules, leading to permanent coloration of the crown. The intensity of discoloration is proportional to the degree of pulpal necrosis, the greater the duration of chromogenic materials in the pulp tissue, the greater the depth of discoloration.[2,12]

Internal bleaching can only be performed by a dentist through intracanal delivery of the bleaching agent into the pulp chamber. The endodontically treated root canal should be sealed with a barrier of some sort like Glass Ionomer Cement (GIC) or Resin-Modified Glass Ionomer Cement (RMGIC) to avoid leakage of the material. Internal bleaching is optimally done in several visits to the clinic.[5]

The indications for internal bleaching are discoloration with pulp chamber source, dentinal discoloration, intrinsic stains that are unremovable by external bleaching methods, and mild to extensive tetracycline-discoloration. Contradictions are enamel surface staining, defects of the enamel, caries, major loss of dentinal structure, discolored composite restorations, and teeth with an unpredictable prognosis for treatment.[9]

The two most widely used techniques for endodontic bleaching of teeth include the walking bleach and thermocatalytic technique. The safest and most comfortable approach utilizing fewer visits is the ambulatory bleach technique, through the application of sodium perborate with distilled water or 35% hydrogen peroxide.[13] The thermocatalytic treatment involves the introduction of an oxidizing agent within the pulp chamber and subsequent application of heat

using a lamp, hot instrument, or a specially designed device but is risky and less frequently advised. Internal bleaching, especially with the walking bleach method, was discovered to be a conservative and biological treatment in the management of intrinsically colored non-vital teeth.[10,14] In this case, the walking bleach technique was chosen as a minimally invasive, and cost-effective approach to manage post-traumatic discoloration. This method is considered safe, requires fewer visits, and preserves sound tooth structure compared to full-coverage restorations.

While internal bleaching is highly effective, risks and complications are also present, the most severe of which is external cervical root resorption (ECRR). This condition is also linked to peroxide diffusion via dentinal tubules and cemental defects into the periodontium and causing inflammatory responses.[9] Prevalence of ECRR is as mentioned, though risk is extremely high when high concentrations of hydrogen peroxide are used with heat application in the thermocatalytic technique.[3] Other unwanted effects include increase in permeability of dentin, microhardness decrease, and temporary bond strength decrease of composite restorations.[8,15]

To minimize these risks, several preventive steps must be adopted. A good cervical seal of a minimum thickness of 2 mm by resin-modified GIC or glass ionomer cement must be positioned above the root filling to prevent leakage of peroxide into the root canal or periodontal tissues.16 Avoid employment of the thermocatalytic technique in place of the walking bleach technique, which is easier with higher patient acceptability.[6,14] It is also advisable to employ calcium hydroxide after bleaching for neutralization of remaining peroxide, raising the pH, and hence preventing external root resorption.[16] Final composite restorations must also be postponed for 1-3 weeks after bleaching to provide time for complete evaporation of residual peroxide, which otherwise will interfere with polymerization and weaken adhesion.[17-19]

The prognosis of internal bleaching is generally favorable. Long-term follow-up studies have demonstrated success rate exceeding 80-90% over 10-25 years, particularly when strict clinical protocols are followed. However, clinical outcomes may vary depending on the etiology of discoloration, the age of the tooth, the quality of the cervical seal, and adherence to follow-up care. Patient satisfaction remains consistently high, as this procedure restores esthetics without aggressive removal of tooth structure.[20-22]

In this case, a hydrogen peroxide-based bleaching agent was used. Hydroge peroxide is a highly oxidizing agent and must be applied as a high concentration agent with care, since it is thermodynamically unstable and explosive. The bleaching agent can be applied with a plastic instrument and plugger and must be renewed 3-7 days. Typically, 2-4 sessions are required, depending on the intensity of the discoloration. In this case, two sessions were sufficient to achieve a shade comparable to the adjacent tooth. The patient was instructed to monitor the tooth daily to prevent overbleaching. When the bleaching solution comes in contact with the tooth, hydrogen peroxide is released and enters the dentin and the enamel because it has a relatively low molecular weight (30 g/mol). These reactive molecules attack the dark chromophore compounds with long molecular chains, breaking them down into smaller, less pigmented, and more diffusible molecules.[3] Restoration after internal bleaching using a

composite resin. The residual peroxide of the bleach, particularly hydrogen peroxide can influence composite bonding strength, and therefore waiting for a few days following bleaching prior to composite repair is recommended. The use calcium hydroxide in the pulp chamber for a few days has the advantage of acid buffering from the bleaching agent.

At the final follow-up, the patient remained asymptomatic. Clinical examination demonstrated negative responses to percussion and palpation, a well-fitting restoration, and healthy gingival tissues. Radiographic assessment confirmed a hermetic obturation. The favorable outcome in this case can be attributed to several contributing factors, including effective disinfection, hermetic obturation using a bioceramic sealer, and the prevention of coronal microleakage, all of which are critical determinants of successful root canal treatment.

CONCLUSION

Internal bleaching using the walking bleach technique is a conservative and effective esthetic treatment for intrinsically discolored non-vital teeth following endodontic treatment. Compared to restorative approaches, it is less invasive, more economical, and preserves natural tooth structure while providing satisfactory esthetic outcomes. Possible adverse effects can be prevented by ensuring proper cervical sealing, avoiding thermocatalytic methods, protecting gingival and labial tissues, and refraining from the use of highly concentrated bleaching agents. When performed under controlled conditions and followed by adequate restorative sealing, internal bleaching represents a safe and reliable approach that improves dental esthetics and patient quality of life.

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