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### Abstract

A patient presented with tooth discoloration due to trauma, which had caused a tooth to become non-vital. Such trauma can damage the pulp tissue, eventually leading to necrosis and discoloration over time. In cases like this, internal bleaching is a treatment procedure aimed at improving the color of non-vital teeth. Discoloration of teeth after endodontic treatment often raises concerns for both patients and dentists. Whitening the tooth after root canal treatment is important to restore its original color before a permanent restoration is placed. The objective of this report is to present the successful outcome of internal bleaching in patient who had undergone root canal treatment ten years earlier. A 39-year-old male presented with a complaint of discoloration in the right maxillary central incisor. The patient had a history of root canal treatment on the tooth performed ten years prior. Radiographic examination confirmed that tooth 11 had undergone root canal treatment. Internal bleaching was performed on tooth 11, which appeared darker than the adjacent teeth. Whitening was carried out using 35% hydrogen peroxide. By the fourth visit (one week after the third application), the tooth color had changed to shade D3, which matched the desired color. This indicated a significant improvement in shade. Internal bleaching using 35% hydrogen peroxide resulted in color enhancement consistent with patients expectations. The treatment proved effective in restoring the esthetics of a non-vital tooth discolored due to trauma.

## INTRODUCTION

Discoloration of anterior teeth is a common esthetic concern that frequently prompts patients to seek dental treatment. The causes of tooth discoloration are diverse and may be classified as intrinsic, extrinsic, or a combination of both, each varying in appearance, location, and severity. Among the intrinsic factors, dental trauma is a significant cause, as it can initiate biological changes within the pulp cavity and surrounding supporting tissues. If not managed appropriately, these changes may lead to discoloration of the tooth crown (Natsir *et al.*, 2024; Nugroho *et al.*, 2024).

Discoloration of anterior teeth is often an esthetic concern that prompts patients to seek treatment. Common restorative options to address this issue include crowns and veneers. However, in many cases, the discoloration can be partially or completely corrected through bleaching procedures (tooth whitening). Bleaching can be performed via two main approaches: internal bleaching, which is carried out within the pulp chamber, and external bleaching, which is applied to the tooth surface. In selected clinical cases, bleaching offers a conservative, non-invasive alternative to restorative treatments such as crowns or veneers (Torabinejad *et al.*, 2020).



Bleaching procedures can be performed internally on non-vital teeth and externally on vital teeth. Internal bleaching is a whitening technique for non-vital teeth that have undergone root canal treatment, involving the placement of a strong oxidizing agent inside the pulp chamber. This case is significant because tooth discoloration resulting from trauma not only affects esthetics but can also impact the patient's self-confidence. Therefore, selecting the appropriate approach to manage discoloration is a critical component of comprehensive restorative care. This case report presents an internal bleaching procedure using the walking bleach technique on the right maxillary central incisor, which had undergone root canal treatment approximately ten years earlier due to trauma (Djuanda, 2019; Meizarini & Rianti, 2005).

### CASE SUMMARY

A 39-year-old male presented to RSGM X with the chief complaint of a darkened upper right incisor and requested treatment. Based on the anamnesis, the patient had experienced dental trauma 10 years earlier, and the affected tooth had undergone root canal treatment. There was no pain or other subjective symptoms. Intraoral examination revealed no tenderness on palpation, no sensitivity to percussion, and no mobility. Radiographic examination showed that tooth #11 (right maxillary central incisor) had a root canal filling, with the periodontal ligament space within normal limits and no signs of periapical pathology. The diagnosis for tooth #11 was post-root canal treatment discoloration with a history of pulp necrosis and a favorable prognosis. The treatment plan included internal bleaching of tooth #11 followed by composite restoration, as shown in Figure 1.



Figure 1. Initial Clinical Appearance and Periapical Radiograph

### CASE MANAGEMENT

#### First Visit:

On the first visit, the patient's dental condition was examined. The patient was given an explanation of the tooth discoloration, the treatment plan, the internal bleaching procedure, the success rate, possible side effects, and the potential for treatment failure. After receiving adequate information, the patient agreed to undergo internal bleaching as a treatment for the tooth. Intraoral examination showed that tooth #11 was darker than the other teeth. The percussion test was negative, the gingiva appeared normal, and the vitality test was negative. A radiographic examination showed a radiopaque filling in the root canal of tooth #11.

The tooth color was recorded before starting the treatment by matching it with a shade guide, and the initial color was C4 (Lumin® Vacuum from Vita). The treatment began by isolating the working area, then removing the root canal filling material to a depth of 2 mm from the orifice, followed by irrigation with sterile distilled water. Afterward, a cervical seal was applied using a glass ionomer with a thickness of 2 mm. The glass ionomer was contoured to follow the cervical line. Once the material hardened, a 35% hydrogen peroxide-based bleaching agent (Opalescence Endo, Ultradent) was applied and then covered again with glass ionomer.

#### Second Visit:

The patient came for a follow-up one week after the first application. Intraoral examination showed a color change in the tooth, but it had not yet reached the patient's desired shade. The temporary restoration was then removed, the tooth was irrigated with sterile distilled water, and the walking bleach material with 35% hydrogen peroxide was reapplied. Afterward, the tooth was sealed again with glass ionomer material.



Figure 2. Color Change at the Second Visit

#### Third Visit

The patient returned for a follow-up one week after the second application. Intraoral examination showed a colour change from C4 to A4, but patient wants a brighter one. The temporary restoration was removed again, the tooth was irrigated with sterile distilled water, and the walking bleach with 35% hydrogen peroxide was reapplied. The tooth was then resealed with glass ionomer.



Figure 3. Color Change at the Third Visit

#### Fourth Visit

At the fourth visit, one week after the third application, it was observed that the color had changed to D3 and matched the desired shade. The cavity was irrigated with sterile distilled water, then calcium hydroxide was applied inside the tooth to neutralize any remaining bleaching agent in the dentinal tubules. The cavity was then sealed with calcium hydroxide.



Figure 4. Color Change at the Fourth Visit

#### Fifth Visit

Two weeks later, there was no complaint from the patient.

### **DISCUSSION**

Aesthetics is one of the key aspects and goals of endodontic treatment. One of the factors affecting aesthetics is tooth discoloration. In general, the causes of discoloration can be classified into two categories: extrinsic and intrinsic, based on the location and cause. Extrinsic discoloration is usually triggered by the consumption of coffee, tobacco, or certain foods (Patil, 2002; Rosidah *et al.*, 2017). In contrast, intrinsic discoloration can be caused by pulp hemorrhage, pulp tissue decomposition, breakdown of blood products, and bacterial activity. In addition, discoloration can also be influenced by the use of intracanal medicaments, obturation materials, systemic medications, and metallic or amalgam restorations (Puspita, 2017). In non-vital teeth, discoloration typically occurs due to pulp degeneration caused by trauma or suboptimal root canal treatment, such as inadequate irrigation during biomechanical preparation or improper access cavity preparation, leading to residual pulp tissue that has not been completely removed. Understanding the cause of discoloration is crucial, as it significantly affects the success of the treatment provided (Halim, 2015).

Trauma to tooth 11 can cause rupture of capillaries within the pulp chamber, leading to bleeding. Blood and its components diffuse into the dentinal tubules. Subsequently, red blood cells undergo hemolysis and release hemoglobin, which then degrades into iron-containing components (Anugrahati *et al.*, 2020). The iron reacts with hydrogen sulfide, a byproduct of bacterial metabolism, forming ferric sulfide, a dark-colored compound. This compound penetrates the dentinal tubules, causing discoloration of the tooth crown. If the pulp becomes necrotic, this discoloration is typically permanent. Tooth discoloration can be managed using various methods, such as veneers, full crowns, or bleaching treatment. In this case, the chosen treatment was bleaching (Soesilo, 2016).

The main material used in the bleaching procedure is hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) at a concentration of 35%.  $\text{H}_2\text{O}_2$  is a clear, odorless, unstable, and acidic liquid. Due to its small molecular weight,  $\text{H}_2\text{O}_2$  can diffuse through enamel and dentin. The bleaching process occurs through a redox (oxidation-reduction) reaction. In this redox reaction, the oxidizing agent ( $\text{H}_2\text{O}_2$ ) releases free radicals, which are unpaired electrons (Aulia & Budiono, 2023). These free radicals bind to organic molecules rich in double bonds to achieve stability, breaking these bonds and forming simpler compounds, ultimately leading to a lighter tooth color. Indications for non-vital tooth bleaching include necrotic teeth, teeth with pulp hemorrhage, properly treated endodontic cases, and cases where the coronal structure is not severely compromised. Contraindications include extensive caries, inadequately sealed root canal fillings, or root canal fillings using silver points (Mona, 2018).

There are many methods used for internal tooth bleaching, one of them is the walking bleach technique. The walking bleach technique involves placing the oxidizing agent inside the pulp chamber and leaving it in place for 3–7 days. This procedure can be performed in one or several visits until the desired tooth color is achieved. The combination technique combines the use of the bleaching agent in the pulp chamber with heat application for approximately 12 minutes, followed by sealing the cavity for continued treatment over multiple visits. Intra-coronal teeth whitening using the walking bleach technique using hydrogen peroxide accompanied by composite resin restorations gave good results on the central incisor teeth of the maxillary central incisor teeth that are discolored. Several things need to be considered in teeth whitening with this technique so that unwanted side effects can be prevented (Istanto, 2020). Amato *et al* (2018) reported a 25-year follow-up with a success rate of 85%, suggesting that non-vital teeth whitening is an effective long-term procedure to treat discoloration. Although some studies and case reports have included follow-up, longer follow-up periods will contribute more strongly to the validity of findings in future case reports (Amato *et al.*, 2018).

In this case, the technique used was the walking bleach method, as it is an internal procedure proven to be the most effective, the safest, and requires relatively fewer visits (Cohen & Hargreaves, 2020). Several important factors must be considered before performing internal bleaching such as ensuring the quality of the root canal filling is adequate and creating a cervical seal to prevent the bleaching agent from leaking into the root canal or periodontal tissues. Rotstein *et al.* reported that applying a 2 mm-thick layer of glass ionomer can prevent 30% hydrogen peroxide from penetrating the root canal, and after the procedure, this material can also serve as a base for the final restoration (Rotstein & Walton, 2009). The cervical seal is created by removing the gutta-percha to a depth of 1–2 mm below the cemento-enamel junction. A periodontal probe can be used to measure this depth by inserting it into the pulp chamber. It is also important to ensure that the cavity is free from residual filling material or debris, as their presence may reduce the effectiveness of the bleaching agent (Dotzel & Rawlinson, 2017; Ingle *et al.*, 2019).

Restoration with composite material should ideally be performed 1 to 3 weeks after bleaching treatment. This is because residual hydrogen peroxide may inhibit the polymerization process of the composite and reduce the bond strength to the enamel. This

reduction in bond strength is temporary, typically decreasing within 24 hours and completely resolving after one week (Dahl & Pallesen, 2013).

The use of calcium hydroxide aims to increase the pH in the pulp chamber to a more alkaline level, as well as to prevent potential bone resorption (Nirwana *et al.*, 2024). Additionally, applying calcium hydroxide helps eliminate any residual 35% hydrogen peroxide that may affect the bonding strength between the composite resin and the tooth. Following this step, the cavity is restored with composite material, and the patient is scheduled for a follow-up at the next appointment (Margaretta & Indriana, 2020; Walton & M, 2008). This report has several limitations, including the length of time since root canal treatment ( $\pm 10$  years) which may affect the tooth's response to whitening agents, and the lack of detailed documentation of trauma history. These factors limit the generalizability of the results and interpretation of the effectiveness of the walking bleach technique for similar cases with different conditions.

## CONCLUSION

Internal bleaching using the walking bleach technique with hydrogen peroxide as the bleaching agent can successfully achieve the desired whitening outcome in teeth discolored due to trauma. This technique can be considered a viable option for restoring the esthetics of discolored non-vital teeth.

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