



ISSN Print: 2394-7489  
ISSN Online: 2394-7497  
IJADS 2024; 10(2): 242-245  
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[www.oraljournal.com](http://www.oraljournal.com)  
Received: 13-01-2024  
Accepted: 20-02-2024

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## Management of discolored immature permanent incisor associated with triple antibiotic therapy: A case report

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DOI: <https://doi.org/10.22271/oral.2024.v10.i2d.1947>

### Abstract

A mixture of minocycline, ciprofloxacin, and metronidazole, known as Triple Antibiotic Paste, was applied within the root canal as a medicament to disinfect it. While minocycline effectively combats bacteria, its use within the tooth crown can lead to noticeable discoloration. We presented a case of 11-year-old female reported with fractured immature teeth in the upper anterior region. The final diagnosis was Ellis class IV fracture IRT 11. Apexification with biodentine was planned, followed by root canal treatment. Triple antibiotic paste was used IRT 11 as an intra-canal medicament, resulting in dark discoloration. A walking bleach procedure was scheduled to address this aesthetic issue.

**Keywords:** Minocycline, biodentine, apexification, walking bleach procedure

### Introduction

The aesthetic appearance of teeth holds considerable significance for patients, with tooth color representing a crucial aspect thereof. Discoloration, particularly noticeable in anterior teeth, can present a significant aesthetic concern, leading to psychological implications that affect the patient's confidence<sup>[1]</sup>.

Dental injuries can happen across all age ranges, but children are notably more susceptible to them<sup>[2]</sup>. Immature teeth are especially susceptible to traumatic injury, which can disrupt their natural maturation process and prevent the closure of the apex. In instances where this occurs, a procedure known as apexification becomes necessary. Apexification is a procedure used to induce the formation of a calcified barrier at the root end in teeth with open apices or to promote continued apical development in teeth with incompletely formed roots and necrotic pulp<sup>[1]</sup>. Due to limitations associated with traditional apexification utilizing calcium hydroxide, such as dentinal wall weakening, porous barrier formation, and the need for multiple treatment sessions to finish, The current method involves creating an artificial apical plug using modern calcium silicate-based materials. Biodentine, a recently introduced bioactive substitute for dentin, shows great promise in this regard. It is a cement that stimulates the formation of hard tissue, specifically reactive or reparative (tertiary) dentin<sup>[3]</sup>.

Intrinsic tooth discoloration can be caused by systemic factors like medication use (tetracycline), genetic conditions (like amelogenesis imperfecta, hyperbilirubinemia, & dentinogenesis imperfecta), as well as local factors including, intrapulpal hemorrhage, pulp necrosis, remnants of pulp tissue following root canal treatment, use of intracanal medicaments, dental fillings, root resorption, and aging<sup>[4]</sup>. A blend of ciprofloxacin, metronidazole, & minocycline, commonly known as triple antibiotic paste, has been advocated as an intra-canal therapeutic agent to disinfect the root canal system. TAP is prepared by mixing equal quantities of the three antibiotics in powdered form with saline or sterile water. Subsequently, this paste is placed within the canal and left sealed for a period of three weeks. However, a potential drawback of TAP usage is the discoloration it can cause to tooth structure, leading to an undesirable aesthetic outcome<sup>[5]</sup>. The intracoronal walking bleach method is recommended for asymptomatic teeth that have undergone root canal therapy.

Presently, hydrogen peroxide is the chosen bleaching agent due to its inclusion of active free radicals<sup>[6]</sup>.

This case report aimed to illustrate the management of discolored immature teeth following trauma, subsequent to the application of triple antibiotic paste, utilizing the Walking bleach technique.

### Case Report

A 11-year-old female patient reported to the Department of Pediatric and Preventive Dentistry, Kothiwal Dental College and Research Centre, with the chief complaint of Trauma in the upper front tooth region. The patient gave the history of a fractured tooth in the upper anterior region of the jaw 1 month back. She also complained of pain and mobility of the same tooth. In the past dental history, she had visited a local dentist, where her tooth was splinted. Presently, the patient did not complain of pain, but wanted the treatment to be done for the traumatized tooth. Past medical history was not relevant. On intraoral examination, tooth # 11 exhibited an Ellis class IV fracture, without mobility, no tenderness on percussion, and was unresponsive to electric pulp testing (Figure 1). On radiographic examination, the tooth displayed an incompletely developed root with thin dentinal walls and an open apex (figure 2). The final diagnosis was an Ellis class IV fracture in the permanent right maxillary central incisor. Apexification using Biodentine was planned to ensure effective obturation with a proper seal.



**Fig 1:** Preoperative photograph with Splinting



**Fig 2:** IOPAR showing an incompletely formed apex #11 and an Ellis class IV fracture #11

Splint was removed (Figure 3). Endodontic treatment was started and the access opening was done. Working length was determined with 60 No K-file (Figure 4).



**Fig 3:** Intraoral photograph after removing splint



**Fig 4:** Working length determination

The root canal was copiously irrigated with saline and sodium hypochlorite was used carefully. Cleaning and shaping of the canal was done. Paper points were used to dry the canal. Ciprofloxacin, metronidazole, and minocycline were powdered and mixed with saline until a creamy consistency was achieved. This antibiotic blend was then used as an intracanal medicament, and the access cavity was sealed with a temporary restoration. The patient missed the next appointment and returned after 4 weeks, reporting discoloration of tooth #11 (figure 5). Saline irrigation was performed extensively to remove the antibiotic paste from the canal.



**Fig 5:** Tooth showing discoloration

Sterilized Paper points were used for drying the canal. Biodentin was prepared according to instructions and condensed with less apical pressure using hand plunger instruments to form an apical plug about 3-4 mm (Figure 6). After that, A moist cotton was placed over the Biodentine within the canal and closed with temporary restoration. After 24 hours, obturation was completed with the gutta percha cone (Figure 7).



**Fig 6:** Apical plug made with Biodentin



**Fig 7:** Obturation with gutta percha

1 week later, a Walking bleach procedure was scheduled to address the aesthetic issue. An intra-orifice barrier was placed 2 mm below the cemento-enamel junction using glass ionomer cement (Figure 8), The chamber underwent etching with 37% phosphoric acid for 30 seconds, followed by washing and drying. A thick mixture of a bleaching agent (Sodium perborate combined with 30% hydrogen peroxide in a ratio of 2 g:1 mL) was applied to the pulp chamber. Dry cotton was firmly placed over this, and the cavity was sealed using temporary restoration. The patient was scheduled for weekly follow-up appointments to repeat the bleaching procedure until the desired results were achieved (see Figure 9). Before each session, the outcome was assessed clinically by comparing the tooth shade with previous records using the Vita shade guide (C3) and earlier photographs.



**Fig 8:** GIC barrier in skyline appearance



**Fig 9:** a) Follow up after 1 week; b) Follow up after 2 week

After a few appointments, the teeth were lightened to a superior esthetic shade, A2. One week later, permanent restoration was performed on the tooth, including aesthetic composite build-up. (Figure 10).



**Fig 10:** Composite build up i.r.t 11

**Discussion**

The causes of tooth discoloration are diverse and complex, typically categorized as either intrinsic, extrinsic, or internalized. Extrinsic discoloration affects the outer surface of the tooth structure, while intrinsic discoloration occurs within the tooth structure, where chromogens penetrate enamel and dentin during tooth development or after eruption. Intrinsic discoloration after tooth eruption includes pulp necrosis, restorative & endodontic materials, aging, trauma, caries, and parafunctional activity<sup>[6]</sup>. Triple antibiotic paste (TAP) is an intracanal medication composed of ciprofloxacin, metronidazole, and minocycline. The effectiveness of TAP in sterilizing the root canal from polymicrobial infections is well-established<sup>[5]</sup>. Minocycline, an antibiotic present in TAP, is responsible for tooth discoloration. It is a semi-synthetic derivative of tetracycline effective against both gram-positive and gram-negative bacteria. Minocycline binds to calcium ions through chelation, forming an insoluble complex. This incorporation of minocycline into the tooth structure causes discoloration<sup>[7]</sup>.

Reducing the application time of the pastes may help prevent the discoloration caused by minocycline use. Experimental studies on TAP have shown that applying the medication for 24 to 48 hours is adequate for effectively disinfecting infected root dentin. Sato *et al.* recommended limiting the use of minocycline in the triple antibiotic paste due to the risk of tooth discoloration. They explored substitutes for minocycline and identified cefaclor and fosfomycin as potential alternatives, considering their antibiotic effectiveness. However, further clinical studies are needed to confirm the efficacy of these medications in root canal treatments<sup>[8]</sup>.

Over the years, various procedures have been suggested for the management of discolored nonvital teeth. One such method is the walking bleach technique, which relies on the chemicals like hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) or sodium perborate (SP) to release active oxygen. The walking bleach procedure typically involves the combination of SP or H<sub>2</sub>O<sub>2</sub> with water. Initially described by Spasser, in this method, sodium perborate is mixed with distilled water. When combined with water, sodium perborate releases H<sub>2</sub>O<sub>2</sub>. However, Nutting and Poe later modified this technique by replacing water with 30% H<sub>2</sub>O<sub>2</sub> to enhance its effectiveness. However, this modification increased the risk of external cervical root resorption, so caution should be exercised when using it. Intrinsic discoloration from necrotic pulp is caused by pigmentation consisting of long-chain organic molecules. Bleaching with H<sub>2</sub>O<sub>2</sub> causes oxidation of these long-chain molecules, transforming them into carbon, while simultaneously releasing H<sub>2</sub>O and O<sub>2</sub><sup>[2]</sup>.

Glass ionomer cement was employed as a barrier material in the configuration of a 'bobsled tunnel' when viewed from the facial aspect. This shape is vital as it proficiently seals all dentinal tubules extending from the pulp chamber to the outer surface of the tooth, situated beneath the epithelial attachment level. This containment ensures that the bleaching agent stays confined within the cavity, thus averting external root resorption<sup>[9]</sup>.

Walking bleach method entails applying a dense paste containing sodium perborate mixed with either water or H<sub>2</sub>O<sub>2</sub> in the pulp chamber. This is left in place for 3 to 7 days, followed by review visits. The process is repeated until the desired results are achieved. Bleaching occurs gradually between dental appointments as the bleaching agent remains sealed within the pulp chamber<sup>[4]</sup>.

Composite resin was used for the final restoration. It is essential to delay the restoration for approximately 1-2 weeks after tooth bleaching to eliminate any remaining free radicals in the pulp chamber. Residual free radicals may affect the bonding strength of the composite resin to the tooth structure and disrupt the polymerization process of the composite resin. If direct composite restoration is applied on the same day as internal bleaching, a 10% ascorbic acid solution can be placed in the pulp chamber for 10 minutes to reduce the amount of free radicals in the pulp chamber<sup>[10]</sup>.

## Conclusion

Internal bleaching using the walking bleach method is an effective treatment for intrinsic discoloration caused by triple antibiotic paste in immature teeth affected by trauma. This approach typically yields satisfactory aesthetic results, leading to high patient satisfaction. The prognosis for this case was favorable due to the patient's cooperation and the treatable nature of the tooth condition.

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### How to Cite This Article

Bezborah B, Chaitra TR, Manuja N, Gayan A. Management of discolored immature permanent incisor associated with triple antibiotic therapy: A case report. *International Journal of Applied Dental Sciences* 2024; 10(2): 242-245.

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