

MANAGEMENT OF DISCOLOURATION IN MATURE PERMANENT TEETH FOLLOWING REGENERATIVE ENDODONTIC PROCEDURE: A CASE REPORT

Dentistry

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ABSTRACT

Regenerative endodontic procedures involve meticulous disinfection and impervious sealing of the root canal. Mineral trioxide aggregate (MTA) has been the commonly used material to achieve the coronal seal. However, MTA's potential for tooth discolouration and its management is challenging in regenerative endodontics. Internal bleaching has emerged as a reliable solution for post-procedure discoloration. The present case report demonstrates, successful reversal of crown discoloration caused by MTA using sodium perborate after 3 month follow-up intervals.

KEYWORDS

“Regenerative endodontic procedure in mature permanent teeth”, “MTA”, “discolouration”, “bleaching”

INTRODUCTION

Regenerative endodontic therapy (RET) is defined as biologically based procedures designed to replace damaged structures, including dentin and root structures, as well as cells of the pulp-dentin complex.¹ Because of the encouraging results of regenerative procedures in young immature permanent teeth, regenerative endodontic procedure has been tried for use in adult teeth with closed apices. Filling the canal with the patient's own tissue reconstructs the nerve and blood supply, providing a natural defense against infections.²

RET involves root canal disinfection using antibiotic paste or Ca(OH)₂, induce bleeding into the root canal system, and establishing a barrier over the blood clot using calcium silicate cements that is biocompatible, promotes hard tissue formation and prevent reinfection.³ However, a significant drawback is potential tooth discoloration caused by the antibiotic paste, blood, or barrier material⁴ which could be of a grave esthetic concern to the patient.

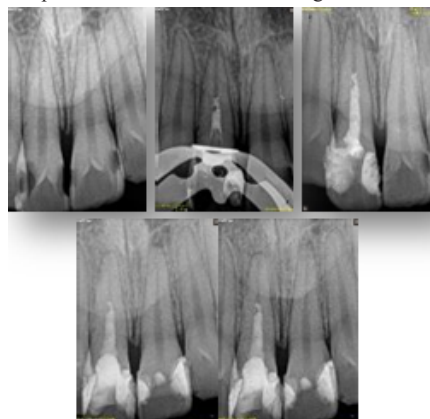
Mineral trioxide aggregate (MTA) is a preferred material for achieving a coronal seal, supported by strong evidence from laboratory and histological studies. These studies demonstrate MTA's effectiveness in blocking bacterial penetration and forming a hard tissue barrier with minimal inflammation. Its exceptional biocompatibility and sealing property makes it suitable for various procedures such as pulp capping, apexification, root resorptions, and revascularization. However, challenges such as poor handling, long setting time, and potential tooth discoloration remain significant drawbacks.⁵

The literature extensively discusses managing intrinsic discoloration and offers two main approaches: tooth bleaching or using composite or porcelain to cover the discoloration (Suliman 2005, Wray & Welbury 2008).^{6,7} Dental bleaching emerges as the ideal option when minimally invasive procedures are favoured. Sodium perborate acts as a potent bleaching agent, especially advantageous for addressing discoloration induced by Triple Antibiotic Paste.⁸ In 2011, Belobrov and Parashos demonstrated an excellent aesthetic outcome following internal bleaching of a mature maxillary incisor (tooth #8) that had become discolored after MTA pulpotomy.⁹ This case report demonstrate the use of internal bleaching in the management of coronal discoloration in mature permanent anterior teeth following successful

After obtaining informed consent, the tooth was anesthetized using 2% Lidocaine with 1:80000 epinephrine. Under rubber dam isolation, the caries was excavated, and the necrotic pulp was removed. The working length was determined using an electronic apex locator and confirmed with a radiograph. The canal was instrumented up to a #60 K-file with irrigation of 1.5% sodium hypochlorite. According to AAE guidelines,¹⁰ the canal was disinfected with 20 ml of 1.5% sodium hypochlorite followed by 20 ml of 17% EDTA, activated using the EndoActivator System. The canal was dried and medicated with calcium hydroxide paste (ApexCal). The tooth was temporarily restored with GIC, and the patient was dismissed for one week.

At the subsequent appointment, the patient remained asymptomatic, and the second stage of RET was performed. The calcium hydroxide was removed, the canal was irrigated with 20 ml of 17% EDTA, flushed with saline, and dried. Bleeding was induced, and a clot was allowed to form. A coronal seal was created with a 4 mm layer of white MTA, and the access cavity was restored with GIC. The next day, the cavity was restored with composite resin. The patient remained asymptomatic at follow-ups of 1, 3, and 6 months. Refer to fig no 1

However, at the 6-month recall blue-greyish discoloration was noted at the cervical area of tooth 11. Internal bleaching was planned to resolve the aesthetic complaint. The tooth was accessed to expose the MTA, and the stained MTA adhering to the dentin walls and floor of the pulp chamber was removed and sealed with glass ionomer cement (FUJI IX, GC). Following which Sodium perborate mixed with saline in a thick consistency was placed in the pulp chamber and sealed with a GIC. Patient was recalled after a week and significant colour changes were observed after a week which was satisfactory to the patient. Under rubber dam isolation, the bleaching agent was removed and GIC restoration was placed. During the next appointment the access cavity was restored with a bonded composite resin restoration. Refer to fig no 2



Case Study

A 17-year-old male presented with a complaint of decayed teeth in his upper front tooth for the past two years. He was asymptomatic. Examination revealed deep proximal caries in tooth 11, unresponsive to cold, heat, and electric pulp tests. Radiographic examination showed coronal radiolucency involving the pulp in tooth 11, with no significant periapical changes. Tooth 11 was diagnosed with pulp necrosis, and a regenerative endodontic procedure (REP) was planned after discussing the benefits and risks.

Fig 1: A- preoperative IOPA showing caries involving pulp irt tooth 11, B- regenerative endodontic treatment irt 11, C- 6 months follow-up post RET, D- post bleaching, E- 3 months post bleaching



Fig 2: A- discolouration of tooth 11 noted during 6 months follow up, B- tooth 11 following internal bleaching

DISCUSSION:

Recently, RET have been used successfully to treat mature permanent teeth with infected necrotic pulps and apical periodontitis.² The success of regenerative endodontics depends on the ability to disinfect and prevent reinfection of the pulp canal space by the placement of coronal seal.

In the present case report ProRoot MTA was used as coronal barrier material. The main issue when using white MTA for regenerative procedures is the development of grey coronal discoloration. This occurs despite efforts to reduce mineral content in the formulation. Various hypotheses suggest that bismuth oxide within the material and blood contamination are key factors triggering and worsening discoloration.¹¹ The composition of calcium silicate cement (CSC) also plays a role in discoloration, with bismuth oxide's interaction with collagen and exposure to temperature and light being proposed mechanisms. The proportion of bismuth oxide in ProRoot MTA powder is 21.6%, but it decreases to 8.4% once the material sets. This decrease is attributed to the interaction of bismuth oxide with collagen, resulting in the formation of a black precipitate. Additionally, the reaction of oxidized bismuth oxide with carbon dioxide contributes to discoloration. However, this mechanism is less likely to occur in REPs due to the absence of air during material setting.¹² Studies show that bleaching techniques can effectively address discoloration caused due to calcium silicate cement.¹³

Internal bleaching, similar to the walking bleach technique for non-vital teeth, is possible after RET because the coronal pulp space remains empty. The cervical sealing material protects the new vital pulp-like tissue from the bleaching agent, allowing effective treatment of tooth discoloration.¹⁴

For intracoronary bleaching, sodium perborate is mixed with water at a ratio of 2gm:1ml. Kirchhoff et al. [8] investigated the efficacy of sodium perborate in bleaching-stained teeth with both open and closed apices, finding that the bleaching outcomes in the group with open apices were comparable to those in groups with closed apices. Hence internal bleaching was performed in this case.

After three months, there was no notable difference in the bleached shade, and the radiograph revealed no signs of periapical changes

CONCLUSIONS:

Discoloration often accompanies regenerative or revitalization endodontic treatment. Clinicians need to familiarize themselves with procedural techniques that mitigate discoloration and understand available management options. In cases where esthetics is a concern, alternatives to MTA, such as bioceramics or tricalcium silicate cements, should be considered. This case report highlights the successful resolution of crown discoloration caused from MTA in REP using internal bleaching.

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