

# Bleaching of a Discolored Tooth with Retrieval of Remnants after Successful Regenerative Endodontics

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## Abstract

**Introduction:** This report presents the retrieval of remnants from a discolored mandibular right second premolar (tooth #29) of a 17-year-old female after a successful regenerative endodontic procedure (REP). **Methods:** The REP was performed in October 2011. Coronal discoloration became of great concern to the patient at a review visit in 2016. A cone-beam computed tomographic scan was taken to investigate the formation of hard tissues within the root canal as well as a region of no calcified tissue formation. During internal bleaching of tooth #29, a black material with particulate inclusions was retrieved and examined histopathologically. **Results:** Five years after the REP, there was complete periapical healing, hard tissue formation within the root canal, and complete maturation of the root apex. A hard tissue bridge was noted at the cemento-enamel junction when the pulp chamber of #29 was reaccessed. The remnants retrieved from the pulp chamber were confirmed to be partly mineral trioxide aggregate (MTA). A normal tooth color was achieved after 3 weeks of internal bleaching. **Conclusions:** MTA remnants within the pulp chamber contributed to the tooth discoloration and appear to have obstructed hard tissue formation. A matrix of oxidized regenerated cellulose seems not to hinder tissue regeneration and is resorbed by these tissues. Other materials with color stability should be selected as coronal barriers for REPs to avoid a potential adverse effect of the MTA on the REP outcome and discoloration. (*J Endod* 2017; ■:1–5)

## Key Words

Dens evaginatus, internal bleaching, mineral trioxide aggregate, nonvital bleaching, revascularization, revitalization, tissue regeneration, tooth discoloration, walking bleach

**D**ens evaginatus (DE) is a dental anomaly that occurs during tooth development resulting in protrusion of a tubercle on the occlusal surface of posterior teeth or the lingual surface of anterior teeth (1). Because the tubercle may extend above the occlusal surface, malocclusion with the opposing tooth occurs as the affected tooth erupts into the dental arches (1). With wear or fracture of the tubercle leading to exposure of dentin or pulp and subsequent ingress of bacteria from the oral cavity, pulpal and periapical pathoses may develop. Regenerative endodontic procedures (REPs) for teeth with necrotic pulps and immature root apices and mostly affected by DE have shown favorable treatment outcomes in recent retrospective cohort studies in comparison with apexification (2, 3).

An unfavorable outcome associated with REPs is potential coronal discoloration, which has been reported in case reports (4), case series (5), and cohort studies (6). Currently, both the American Association of Endodontists (AAE) (7) and the European Society of Endodontology (ESE) (8) have mentioned in their position statements the risk of tooth discoloration after REPs. To minimize the risk of coronal staining, the AAE guidelines have recommended the use of either calcium hydroxide or a low concentration of triple antibiotic paste or double antibiotic paste as the medicament below the cemento-enamel junction (CEJ) and the use of other tricalcium silicate cements besides mineral trioxide aggregate (MTA). The ESE guidelines have mentioned the use of calcium hydroxide as the medicament but still propose the use of either MTA or tricalcium silicate cement beneath the CEJ. However, there are no recommendations in the literature concerning the management of tooth discoloration after an REP. Such discoloration can potentially impact a patient's quality of life and warrants further research.

Tooth discoloration associated with a maxillary central incisor after an REP has been reported, and it was hypothesized that the presence of minocycline within the antibiotic paste had led to the discoloration (5). Remnants retrieved from the pulp canal space after REPs may provide further insight into the reasons for tooth discoloration, but there has been no further investigation on these remnants reported in the literature (9, 10). Internal bleaching has been shown to be a predictable treatment option for discolored maxillary anterior teeth after REPs by leaving part of the MTA barrier (4, 11). This article reports the management of a discolored permanent

## Significance

Regenerative endodontics is incomplete when remnants of MTA obstruct the process of calcification, but oxidized regenerated cellulose seemed not to be a hindrance. This and the discoloration caused by MTA indicate that alternative calcium silicate-based materials should be sought.

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## Regenerative Endodontics

mandibular second premolar with a history of DE after a successful REP and for the first time reports on the remnants retrieved from the pulp chamber.

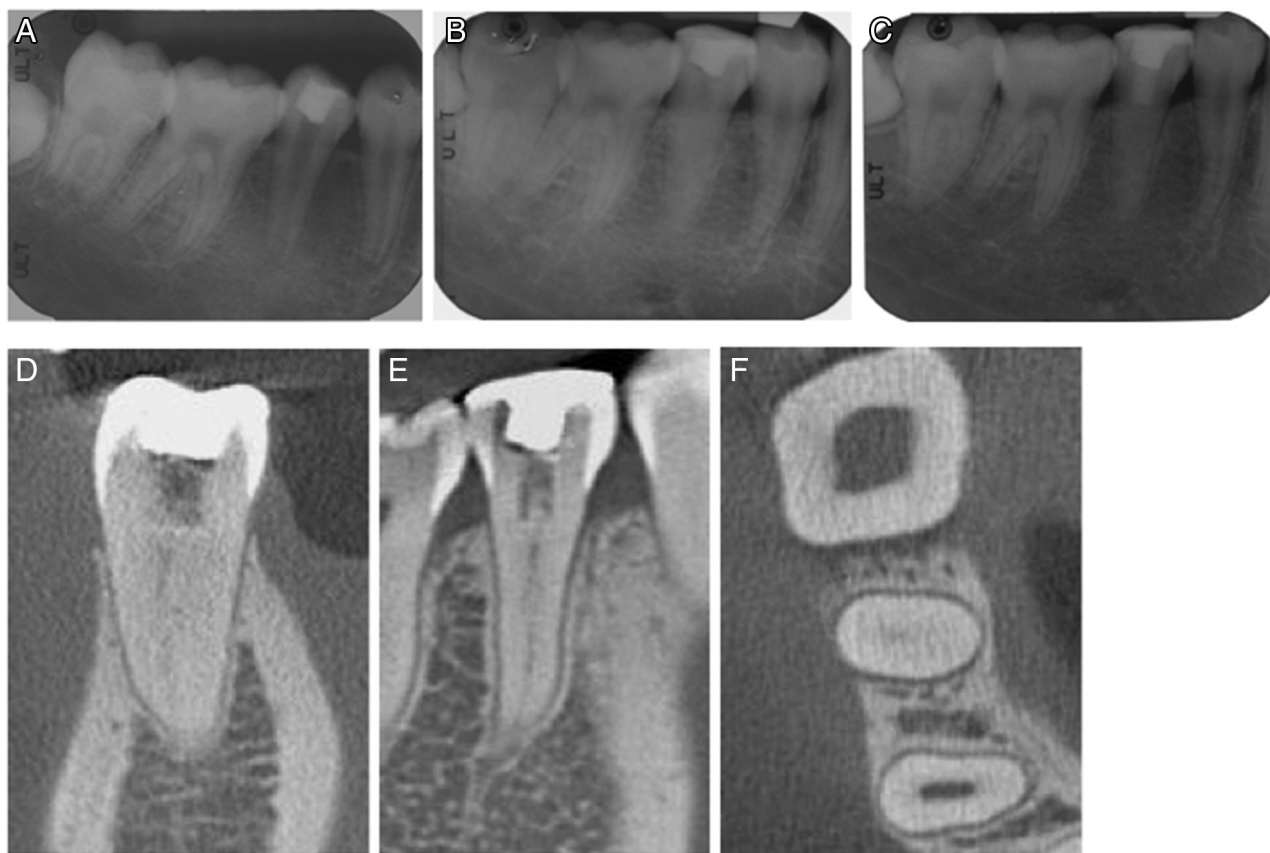
### Case Report

A 17-year-old girl was reviewed after having endodontic treatment of tooth #29. In August 2011, when the patient was 12 years old, tooth #29 was diagnosed with irreversible pulpitis and DE before pulp extirpation by a general dentist. In October 2011, after referral to a university postgraduate endodontics unit, tooth #29 was diagnosed with previously initiated therapy and symptomatic apical periodontitis, and REP was subsequently completed in a single visit. During the procedure, an inferior alveolar nerve block was provided with 2.2 mL 3% mepivacaine without vasoconstrictor (Scandonest 3% Plain; Septodont, Cambridge, Ontario, Canada) before rubber dam isolation of tooth #29. Minimal instrumentation was performed when irrigating the large root canal first with 20 mL 1% sodium hypochlorite (NaOCl) solution for 5 minutes and then 20 mL 15% EDTA solution (EndoPrep; Professional Dentist Supplies Pty Ltd, Bayswater North, Victoria, Australia) for 5 minutes according to the AAE guidelines (7). After drying the canal, bleeding was promoted by placing a prebent #45 H-file (Dentsply Maillefer, Ballaigues, Switzerland) 2 mm beyond the apex and rotating it clockwise several times. A matrix (Surgicel; Ethicon, Somerville, NJ) was placed on top of the blood clot before the placement of approximately 2 mm white MTA (wMTA) (ProRoot MTA White, Dentsply

Maillefer) as a coronal barrier, and tooth #29 was then restored with a polycarboxylate cement base (Durelon; 3M ESPE, Seefeld, Germany) and resin composite only (Fig. 1A) (Tetric N-Ceram; Ivoclar Vivadent, Schaan, Liechtenstein).

The patient had been periodically reviewed and in August 2016 was asymptomatic but was concerned about the grayish-blue coronal discoloration of tooth #29. Although the discoloration was first noted in November 2011, the patient now considered the tooth esthetically displeasing (Fig. 2A). Electric pulp testing of the tooth elicited a positive response. Radiographically, there was substantial narrowing of the root canal below the CEJ and maturation of the root apex but a lack of calcification in the pulp chamber (Fig. 1B). To seek further clarification on the location and extent of hard tissue formation and why hard tissue formation had not occurred within the pulp chamber of tooth #29, a cone-beam computed tomographic scan was taken with a high-resolution machine (80  $\mu$ m) (3D Accuitomo 80; Morita, Kyoto, Japan). At the CEJ level, a complete hard tissue bridge had formed, and a narrow root canal was apparent apical to the bridge (Fig. 1D–F).

The patient and her mother requested internal bleaching of the tooth after the review visit. Local anesthesia was obtained with 2 mL 2% lignocaine with 1:80,000 adrenaline (AstraZeneca AB, London, United Kingdom), and after rubber dam isolation, the pulp chamber of tooth #29 was accessed with the aid of an operating microscope (Möller Allegra 590; MÖLLER-WEDEL GmbH & Co KG, Wedel, Germany). After removal of the Durelon base, the wMTA beneath was found to be black in color. Once the discolored wMTA was removed,



**Figure 1.** Periapical radiographs and cone-beam computed tomographic images of tooth #29. (A) A periapical radiograph taken after the single-visit REP in October 2011. (B) A review radiograph taken in August 2016 at the review visit and consultation regarding tooth discoloration. (C) A postoperative radiograph taken in September 2016 after internal bleaching was completed. Cone-beam computed tomographic images of tooth #29 taken in the (D) sagittal, (E) coronal, and (F) axial planes 5 years after treatment. The axial plane was located just at the hard tissue bridge at the CEJ.

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