Delayed Root Development by Displaced Mineral Trioxide Aggregate after Regenerative Endodontics: A Case Report

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Abstract

Introduction: This case report presents the treatment of a 16-year-old boy with a maxillary lateral incisor (tooth #10) presenting with Oehlers type II dens invaginatus and diagnosed with previously initiated therapy and asymptomatic apical periodontitis. **Methods:** A regenerative endodontic procedure (REP) was performed for the tooth but complicated by apically displaced mineral trioxide aggregate (MTA). Clinical and radiographic examination was undertaken yearly, and a cone-beam computed tomography scan was taken to investigate further the formation of hard tissues within the root canal. Subsequently, tooth #10 was re-accessed and then root-filled with MTA. **Results:** There was complete periapical healing, thickening of the dentinal root walls, and completed apex formation 3 years after REP. Hard tissue formation was noted within the root canal, on the root canal wall, and the root apex through clinical and radiographic examination. Less hard tissue formation was noted on the labial root canal wall where the displaced MTA was located, which was identified on the cone-beam computed tomography scan. **Conclusions:** This report demonstrates that REP can potentially provide excellent treatment outcomes for structurally compromised teeth. REP should be considered as a first-line treatment before proceeding with a root filling when root development is incomplete, but attention to technical detail is essential. *(J Endod 2016;■:1–5)*

Key Words

Dens invaginatus, mineral trioxide aggregate, revascularization, revitalization, tissue regeneration

Significance

This case confirmed that regenerative endodontics can be successful but reports for the first time the possibility of arrested regeneration and asymmetric root development. Technical complications may interfere with tissue regeneration by compromising the vitality of scaffold and stem cells.

Dens invaginatus (DI) is a developmental anomaly resulting in invagination of the enamel organ into the dental papilla, producing a small tooth-like structure within the future pulp chamber before the calcification of the dental tissues (1). The reported prevalence of permanent teeth affected with DI ranges from 0.04% to 10% (2–4), commonly affecting the maxillary lateral incisors, and the classification of Oehlers (5) describes 3 categories of DI. Teeth with DI, infected necrotic pulp, and immature roots present challenges to conventional endodontic treatment because of the large root canals, open apices, and short and thin root-end walls that are more susceptible to cervical root fractures (6). Apexification methods may lead to predictable resolution of the periapical pathoses associated with these teeth but will not improve their structural prognoses (7).

A regenerative endodontic procedure (REP) is a "biologically based procedure designed to replace damaged structures including dentin and root structures, as well as cells of the pulp-dentin complex" (8). The goal of repair rather than regeneration of pulpal tissues is more realistic with REP because histologic studies of human teeth after REPs (9–15) have reported the presence of cementum-like, bone-like, osteodentin, collagen fibers, or fibrous connective tissues. An advantage of this treatment option is that the root canal can be easily re-accessed if the treatment goals are not achieved with REP, and mineral trioxide aggregate (MTA) apexification can then be considered as the next step.

Currently there is limited evidence (16–18) reporting REP as a treatment option of DI in permanent maxillary lateral incisors. In general, these cases were diagnosed with infected necrotic pulps before REP, and the treatment outcomes were positive with periapical healing. In 2 of these cases (16, 17), there was completed apex formation and hard tissue deposition on the canal walls. Despite the heterogeneity of the protocols in these case reports, they show that REP can be considered as an alternative treatment option. This article reports the treatment of a type II DI in an immature permanent lateral incisor tooth with an outcome that has not been previously described.

Case Report

A 16-year-old boy was referred for continuation of endodontic treatment of the permanent left maxillary lateral incisor (tooth #10) with a reported history of labial

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0099-2399/$ - see front matter

http://dx.doi.org/10.1016/j.joen.2016.10.024

parulis, DI, and open apex. The referring dentist did not provide any treatment information or radiographs. On the day of the consultation, the patient was asymptomatic and had no evidence of a parulis. Periodontal probing was within normal limits. Radiographic examination of tooth #10 revealed immature root development and a periapical radiolucency (Fig. 1*A*). The diagnosis of tooth #10 was previously initiated therapy and asymptomatic apical periodontitis with possibly type I or II DI.

After discussing the treatment options with the patient and his mother, the treatment plan was to attempt REP of tooth #10 but consider MTA apexification as a second line of treatment. Endodontic treatment was commenced with the aid of an operating microscope (Möller Allegra 590; Möller-Wedel GmbH & Co KG, Wedel, Germany). 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 #10 was accessed. Internally, a small opening into the root canal was noted; the presence of type II DI was confirmed because of enamel surrounding the invagination, and there was a stained palatal groove on the floor of the dens that communicated with the root canal below the cement-enamel junction (CEJ). The enamel and the stained palatal groove were removed with a tapered diamond endodontic access bur and #90 pulp bur (Komet Dental, Lemgo, Germany). The working length was obtained with an electronic apex locator (Tri Auto ZX; J. Morita Mfg Corp, Kyoto, Japan) and confirmed with a periapical radiograph. The large root canal was lightly instrumented by hand by using a #60/.04 ProFile rotary instrument (Dentsply Maillefer, Ballaigues, Switzerland) and irrigated with 20 mL 1% sodium hypochlorite (NaOCl) solution for 5 minutes according to the American Association of Endodontists (AAE) guidelines (19). Passive ultrasonic activation of NaOCl solution in the root canal was applied for 20 seconds 3 times (20). The root canal was then dressed with calcium hydroxide paste (Calcipulpe; Septodont, Saint-Maur-des-Fossés, France) by using a paste filler (FKG Dentaire SA, La Chaux-de-Fonds, Switzerland). The access cavity was sealed with Cavit (3M, St Paul, MN) and Fuji VII (GC Corporation, Tokyo, Japan).

The patient returned for the second stage of the REP after 6 weeks, remaining free of any symptoms. Local anesthesia was obtained with 2 mL 3% Citanest with Octapressin (Prilocaine 30 mg/mL, felypressin 0.03 IU/mL) (AstraZeneca AB). The root canal was irrigated with 20 mL 1% NaOCl solution for 5 minutes and then 20 mL 15% EDTA solution for 5 minutes. After drying the canal, bleeding was promoted by placing a pre-bent #45H hand file (Dentsply Maillefer) 2 mm beyond the apex and rotating it clockwise several times. A blood clot formed in some 10 minutes up to level of the CEJ. Approximately 1 mm MTA (MTA-Angelus; QED, Peterborough, United Kingdom) was placed onto the blood clot, but it displaced apically and so was then removed

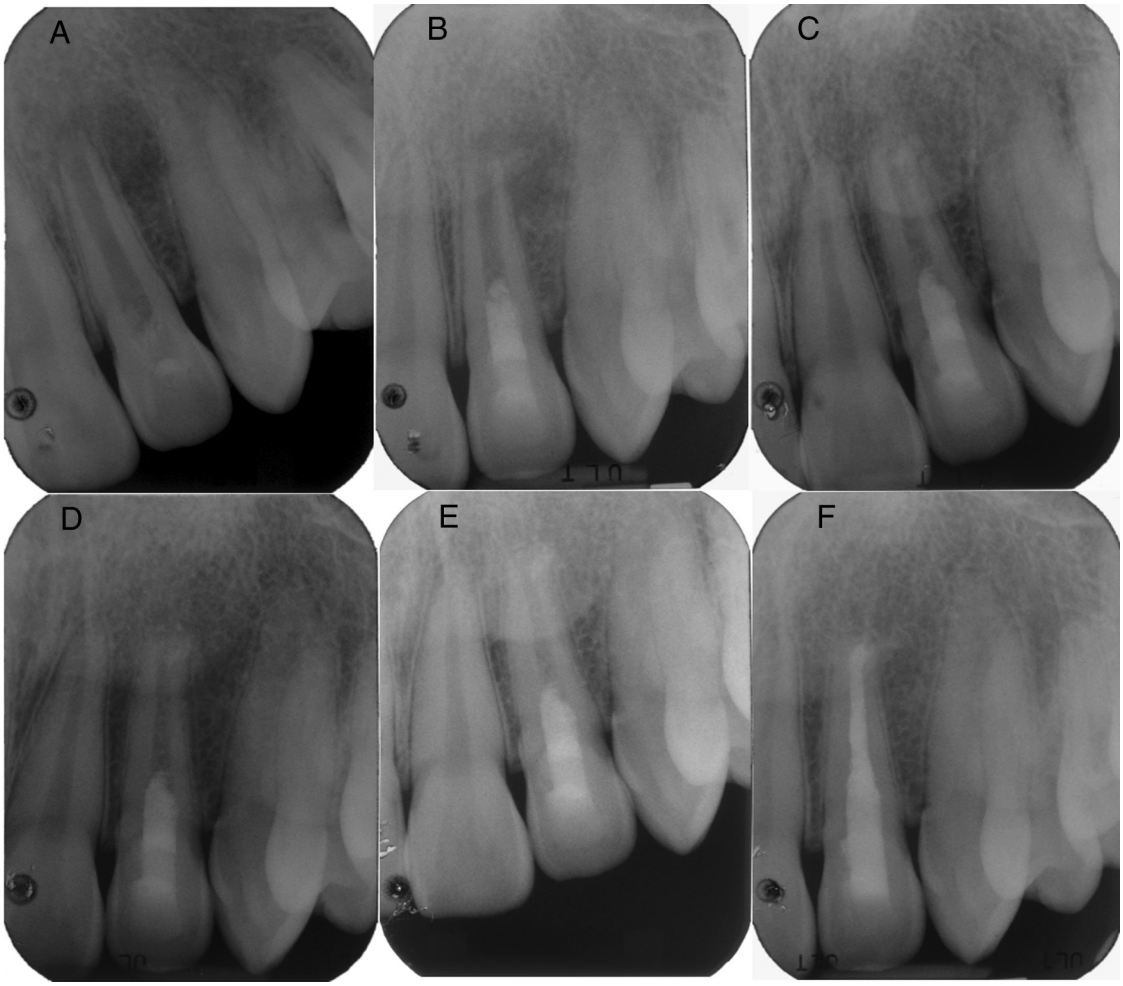

Figure 1. (*A*) Preoperative radiograph of previously initiated permanent left lateral incisor demonstrating Oehlers type II DI with periapical radiolucency, (*B*) immediate postoperative radiograph in May 2013, (*C*) review periapical radiograph after 1 year, (*D*) review radiograph after 2 years, (*E*) review periapical radiograph after 3 years, and (*F*) postoperative radiograph in July 2016.