Mandibular Premolars with Immature Roots and Apical Periodontitis Lesions Treated with Pulpotomy: Report of 3 Cases

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Abstract

This is a case series of 3 immature permanent teeth with dens evaginatus, partial pulp necrosis, and apical periodontitis that were treated by calcium hydroxide pulpotomy. In all cases, follow-up examinations revealed that the radicular pulp vitality was preserved, periapical lesions were healed, and the root canal walls were narrowed by hard tissue deposition. Repair of the apical root differed from case to case; further apical root development occurred in 2 cases, but apical closure was apparent in all of them. This case series report opens a perspective on the use of pulpotomy as an alternative option to treat immature teeth with partial vital pulp tissue and apical periodontitis. *(J Endod 2017;■:1–10)*

Key Words

Apexification, apical closure, calcium hydroxide, immature teeth, pulpotomy

Significance

Immature teeth with necrotic pulps and apical periodontitis lesions are usually treated with apexification or revascularization/regeneration procedures because it is believed that the pulp tissue is entirely necrotic. However, the observation that the radicular pulp may still be vital in some of these teeth, and as such can respond favorably to calcium hydroxide pulpotomy, opens perspectives on the option for conservative pulp treatment of some immature teeth with apical periodontitis.

It is a common belief that apical periodontitis only develops when necrosis and infection affect the entire extent of the pulp to reach the apical foramen. However, several studies have repeatedly demonstrated that varying portions of the radicular pulp may still be vital even when a large periapical radiolucency is observed on the radiograph (1–4). Partial pulp necrosis in teeth with apical periodontitis is clinically evident when the endodontic file instrument provokes bleeding and pain even before it reaches the apical region, as reported in numerous revascularization studies (5, 6). Conceivably, this condition is more frequent in immature teeth because of the rich vascular supply, which carries cellular and molecular components of the immune system through the large foraminal opening and may delay the process of total pulp necrosis. It was speculated that root maturation after revascularization/revitalization treatment provides indirect evidence that vital pulp tissue might have remained in the apical canal space (5–7).

In cases of caries or traumatic pulp exposure in vital immature teeth with normal apical tissue, it is recommended to preserve the remaining vital pulp tissue to allow for root maturation (ie, apexogenesis) (8). However, apexification or revitalization is generally indicated for immature permanent teeth clinically diagnosed with pulp necrosis and apical periodontitis. Apexification is a clinical treatment option of immature non-vital teeth aimed at inducing a calcific barrier at the terminus of the open root apex (9, 10). In the majority of cases there is no evidence of continued root development, and the apical closure is obtained by cementum deposition giving rise to a mineralized tissue bridge (11–13).

Apexogenesis treatment procedure falls under the category of vital pulp therapy for immature teeth. The common clinical indications are cases demonstrating signs of reversible pulpitis, or when the pulp becomes exposed during caries removal or after traumatic injury. Direct pulp capping or partial pulpotomy (Cvek pulpotomy) may also be performed in these cases. It is almost consensual that pulp vitality must be conserved to encourage continued root maturation in immature permanent teeth.

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In principle, immature teeth should be treated as conservatively as possible to allow apexogenesis to occur (14). The purpose of the present report is to demonstrate 3 cases of immature mandibular premolars presenting with clinical diagnosis of necrotic pulp and large periapical radiolucencies. Vital tissue was unexpectedly found in the canals during treatment, and the teeth were successfully treated with pulpotomy procedures.

Case Series

Case 1

A girl who was 12 years and 8 months old was brought by her mother to the dental office of one of the authors (M.T.). The patient complained of swelling of the right cheek and moderate pain in the area of mandibular right premolars. Dental history indicated that the patient did not have any recent dental treatments. The patient's medical history was not contributory. Clinical examination revealed a localized intraoral fluctuant swelling on the buccal aspect and apical to tooth #29 (Fig. 1*A*). Tooth #29 did not have caries, restorations, or artificial crown. However, careful examination revealed that the occlusal surface of the tooth had a circular depression at the center, which is typical appearance of a broken dens evaginatus (Fig. 1*B*). The tooth was slightly tender to percussion (vertical and lateral) and periapical palpation and did not respond to thermal and electric pulp test (EPT), while the neighboring teeth responded normally. Probing of periodontal condition was within normal limits. The tooth had mobility grade 1.

A periapical radiograph revealed that tooth #29 had immature root with open apex and a large apical radiolucency (Fig. 1*C*). Cone-beam computed tomography (CBCT) examination was performed and confirmed the remarkable size of the bony lesion and the immature root (Fig. 1*D–F*). On the basis of the clinical and radiographic examination, a diagnosis of pulp necrosis and symptomatic apical periodontitis was made for tooth #29. The pulpal and periapical pathoses of the tooth were likely due to the fractured tubercle of dens evaginatus, resulting in traumatic pulpal exposure.

No local anesthetic was administered to explore the apical extension of the pulp necrosis. The patient was instructed to refer any discomfort during the procedure. After rubber dam isolation, an access cavity was prepared with diamond burs under copious water through the occlusal surface of tooth #29. The pulp chamber was irrigated with 2% sodium hypochlorite (NaOCl) to remove necrotic tissue. Then, size #20 hand K-file was used to gently explore the canal. Approximately 3 mm beyond the root canal orifice the patient reported discomfort, and intracanal bleeding was observed (Fig. 1*G*). Therefore, it was decided to attempt to maintain the vitality of the remaining pulp tissue in the canal. Consequently, pulpotomy procedure was carried out. Adequate hemostasis was achieved after 2% NaOCl copious irrigation (Fig. 1*G*). The remaining vital pulp tissue was dressed with calcium hydroxide compound (Vitapex; Neo Company, Tokyo, Japan), which was placed up to the level of the root canal orifice (Fig. 1*H*). Next, the access cavity was sealed with glass ionomer cement (Base cement; Shofu, Kyoto, Japan) (Fig. 1*I*). A final postoperative radiograph was taken (Fig. 1*J*).

At the 5-month follow-up visit, the patient reported no symptoms, and the tooth was comfortable. A radiograph showed that the radiolucency had considerably reduced in size, and slight thickening of the canal walls could be appreciated (Fig. 1*K*). At the 9-month follow-up, a radiograph indicated further reduction of the apical radiolucency and increased root thickening (Fig. 1*L*). The periapical lesion showed complete resolution at the 15-month follow-up, with evident further thickening of the canal walls (Fig. 1*M*). CBCT scans taken at this point confirmed the considerable reduction of the periapical lesion's size and provided further details about the radiographic features of the newly formed hard tissue on the canal walls. This hard tissue appeared irregularly deposited on the canal walls, and the root length had not significantly increased, with the typical apical root structure not being formed (Fig. 1*N–P*).

Later, it was decided to restore the tooth permanently. The tooth was isolated with rubber dam, the glass ionomer restoration was removed, and the calcium hydroxide dressing was washed away with NaOCl irrigation. Calcified tissue was found underneath the dressing (Fig. 1*Q*). The access cavity was restored with composite resin. The tooth responded to the EPT similarly to the neighboring teeth. At 16-month follow-up, radiograph revealed that the root canal space appeared narrower than that of the neighboring teeth, and the apex was closed (Fig. 1*R*).

Case 2

A 12-year-old boy was brought to the dental office by his mother for consultation. The patient complained of spontaneous pain in the area of mandibular left second premolar. The patient's dental and medical history was not contributory.

Clinical examination revealed no extraoral and intraoral swelling. Tooth #20 did not have caries, restorations, or artificial crown. The tooth was tender to percussion and did not respond to thermal and EPT sensibility tests. Periapical radiographs showed that tooth #20 had a periapical radiolucency and an open apex (Fig. 2*A*). A careful inspection of the occlusal surface of the tooth showed a round depression with a dark pit in the middle, highly indicative of dens evaginatus fracture (Fig. 2*B*). The tooth was diagnosed with pulp necrosis and symptomatic apical periodontitis.

Without administration of anesthesia, tooth #20 was isolated with rubber dam. Access cavity was prepared through the occlusal surface, and the pulp chamber was irrigated thoroughly with 2% NaOCl solution. A hand #20 K-type file was introduced approximately 2 mm beyond the canal orifice; the patient reported discomfort, and intracanal bleeding was observed (Fig. 2*C*). Pulpotomy was attempted to maintain vitality of the pulp tissue. The remaining apical vital tissue was dressed with Vitapex (Neo Company), and the access cavity was sealed with glass ionomer cement (Fig. 2*D*). A CBCT examination performed after treatment confirmed the wide canal (Fig. 2*E–G*).

After 3 months the tooth was asymptomatic, and a radiograph showed that the radiolucency was considerably smaller (Fig. 2*H*). At the 6-month follow-up, no periapical radiolucency was evident. The pulp canal space was apparently reduced, and the root length appeared slightly increased (Fig. 2*I*). CBCT examination performed at this time revealed that a residual small radiolucency was present, without significant changes in the thickness of the canal walls (Fig. 2*J–L*).

The pulp chamber was revised after 1 year and 10 months. The temporary restoration was removed, and the remnants of calcium hydroxide were washed away with 2% NaOCl. A hard tissue barrier was observed at the site of the pulp wound, which appeared complete at probing (Fig. 2*M*). Moreover, the tooth responded to EPT. Glass ionomer cement was placed over the bridge, and the access was restored with composite resin. Radiograph showed complete resolution of the radiolucency. The canal was consistently narrowed, and the apical root structure was apparently restored (Fig. 2*N*). The situation remained stable at both the 3-year and 5-year follow-ups. The pulp space now appeared very narrow, but total obliteration was not present (Fig. 2*O* and *P*).