Clinical, Radiographic, and Histological Observation of a Human Immature Permanent Tooth with Chronic Apical Abscess after Revitalization Treatment

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Abstract

Introduction: Revitalization procedures have been widely used for the treatment of immature permanent teeth with apical periodontitis. The treatment procedures appear to be capable of encouraging continued root development and thickening of the canal walls. The nature of tissues formed in the canal space and at the root apex after revitalization has been shown histologically in several animal studies; similar studies in humans were recently reported. **Methods:** A 9-year-old boy had a traumatic injury to his upper anterior teeth. Tooth #9 suffered a complicated crown fracture with a pulp exposure, which was restored with a composite resin. The tooth developed a chronic apical abscess. Revitalization procedures were performed on tooth #9 because it was an immature permanent tooth with an open apex and thin canal walls. Twenty-six months after revitalization, the tooth had a horizontal crown fracture at the cervical level and could not be restored. The tooth was extracted and processed for routine histological and immunohistochemical examination to identify the nature of tissues formed in the canal space. **Results:** Clinically and radiographically, the revitalization of the present case was successful because of the absence of signs and symptoms and the resolution of periapical lesion as well as thickening of the canal walls and continued root development. The tissue formed in the canal was well-mineralized cementum- or bone-like tissue identified by routine histology and immunohistochemistry. No pulp-like tissue characterized by the presence of polarized odontoblast-like cells aligning dentin-like hard tissue was observed. **Conclusions:** The tissues formed in the canal of revitalized human tooth are similar to cementum- or bone-like tissue and fibrous connective tissue. *(J Endod 2013;39:1078–1083)*

Key Words

Apical periodontitis, bone-like tissue, cementum-like tissue, immature permanent tooth, revitalization

Since the report of Iwaya et al (1) that a type of treatment termed "revascularization" was applied to treat human immature permanent tooth with apical periodontitis and sinus tract and resulted in not only resolution of apical periodontitis but also thickening of the root canal walls and continued root development, many human immature permanent teeth with apical periodontitis have been treated with revascularization procedures instead of traditional apexification procedures (2). It has been discussed that the term "revitalization" is more appropriate to describe such clinical treatment; therefore, revitalization will be used herein (3, 4). The nature of tissues formed in the root canals of immature teeth with apical periodontitis after revitalization was described histologically as mineralized tissue resembling cementum or bone and periodontal ligament-like tissue in several animal studies (5–8). The nature of the tissue formed in the root canals of human revitalized teeth was recently reported (9–11). We report clinical, radiographic, and histological observation of a human immature permanent tooth with chronic apical abscess after revascularization treatment.

Case Report

Diagnosis and Treatment Planning Visit

A 9-year old boy was referred from the Postgraduate Pediatric Clinic to the Postgraduate Endodontic Clinic at New York University College of Dentistry for the evaluation of tooth #9. The patient had a history of trauma to the upper anterior teeth that occurred from a fall approximately 3 months ago. The patient's chief complaint was "I hit my front teeth 3 months ago, and now I have an infection." The patient did not report any symptoms. Clinical examination showed that tooth #9 had a complicated crown fracture with a pulp exposure, which was restored with a composite resin. A sinus tract was present in the apical area of tooth #9. The tooth was not sensitive to percussion and palpation. It also did not respond to Endo Ice (Coltene/Whaledent Inc, Cuyahoga, OH) or an electric pulp tester (Vitality Scanner; SybronEndo, Glemdora, CA). Radiographic examination revealed a well-circumscribed large periapical radiolucent lesion measuring approximately 8 × 8 mm around the apex of tooth #9 (Fig. 1*A*). The immature tooth had thin canal walls and an open apex (Fig. 1*A*). The clinical diagnosis for tooth #9 was pulpal necrosis and chronic apical abscess. Treatment options including revitalization,

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0099-2399/$ - see front matter

http://dx.doi.org/10.1016/j.joen.2013.04.032

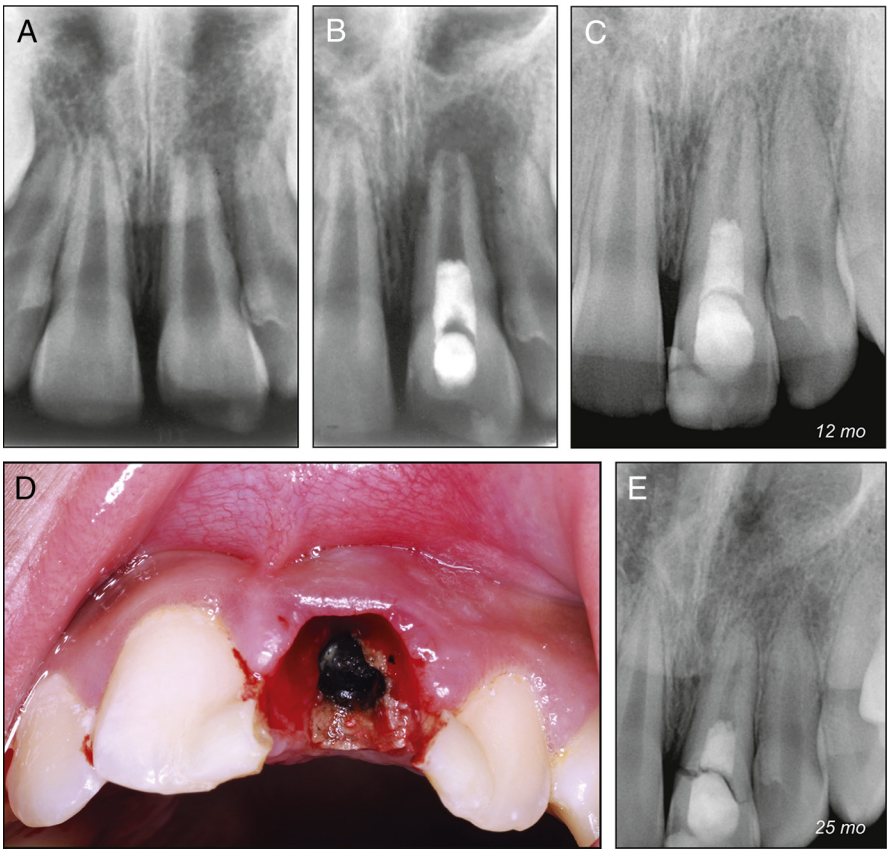

Figure 1. (*A*) Preoperative radiograph: tooth #9 exhibits incomplete formation of the root. Periapical radiolucency is present. (*B*) Postoperative radiograph: the periapical radiolucent area appears to be larger than the preoperative lesion, with sharp margins. (*C*) Follow-up radiograph taken 12 months after revitalization: the periapical radiolucency has resolved with only slight thickening of the periodontal ligament around the root apex. The canal space is reduced in size and the thickness of the canal walls is increased. (*D*) The patient presented after 25 months because the crown was mobile. A complete crown fracture was diagnosed, and the tooth could not be restored. Clinical view after removal of the fractured crown. (*E*) Radiograph taken before removal of the fractured crown. Thickening of the root canal walls increased further. The periapical lesion completely resolved.

mineral trioxide aggregate apexification, and calcium hydroxide apexification were discussed with the mother and child, and after discussion the decision was made to perform a revitalization procedure.

First Treatment Visit

At the first treatment appointment, access to the pulp cavity was obtained under rubber dam isolation without administration of local anesthetic. Purulent exudate and bleeding were noted in the canal. A working length radiograph was taken and recorded at 23 mm. The canal was gently irrigated with copious amounts of 2.6% sodium hypochlorite (Sultan Healthcare, Hackensack, NJ) and dried with paper points. Calcium hydroxide (Henry Schein, Melville, NY) mixed with saline solution was used as an intracanal medication and placed into the apical portion of the canal. The access was closed with a sterile cotton pellet followed by an intermediate restorative material (Dentsply Interntional, Milford, DE).

Second Treatment Visit

Eleven days after the initial treatment, tooth #9 was asymptomatic, and the sinus tract had closed. Local infiltration with 3% mepivacaine without vasoconstrictor was administered. The access cavity was reopened after isolation with a rubber dam. The root canal was irrigated with copious amounts of 2.6% sodium hypochlorite and dried with paper points. Bleeding was induced into the canal up to the coronal third by irritating the periapical tissues with a #30 K-file. Mineral trioxide aggregate (Dentsply Tulsa Dental, Johnson City, TN) mixed with saline solution was placed on the top of the partially coagulated blood clot. The access was sealed with a light-cured composite restoration (Amelogen Plus; Ultradent, South Jordan, UT) (Fig. 1*B*).

Recall Visits

At the 12-month recall appointment, the tooth was asymptomatic. There was radiographic evidence of resolution of the periapical lesion and thickening of the canal walls (Fig. 1*C*). Thus, this case was both an endodontic success in that the periapical lesion had healed and a revitalization success because there was obvious increased thickening of the canal walls and continued root development. Twenty-six months after the completion of the revitalization treatment, the patient presented to the Postgraduate Endodontic Clinic with a horizontal crown fracture at the cervical level of tooth #9 (Fig. 1*D*), and the tooth was determined to be nonrestorable. Radiographically, the tooth showed complete resolution of the periapical lesion and marked thickening of the canal walls as well as closure of the root apex (Fig. 1*E*). Tooth #9 was extracted and processed for routine histological and immunohistochemical examination.

The primary mouse monoclonal antibodies were used against human bone sialoprotein (BSP), dentin sialoprotein, and neurofilament 200 N52 (LifeSpan Biosceiences, Inc, Seattle, WA). The avidin-biotin