Intentional Replantation of an Avulsed Immature Permanent Incisor: A Case Report

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Abstract

This case report discusses the successful endodontic treatment of an open apex maxillary right permanent central incisor that had been avulsed and incorrectly replanted in a 7-year-old patient. The tooth was carefully re-extracted followed by cleaning of the alveolar socket and immediate replantation. However, pulp necrosis was diagnosed, and regenerative endodontic treatment was performed. The root canal system was disinfected by passive ultrasonic irrigation with 2.5% sodium hypochlorite. At the first visit, the tooth was repositioned and immobilized with an appropriate semirigid splint. After 14 days, the splint was removed, and the diagnosis of pulp necrosis was confirmed by thermal testing. The root canal was emptied, disinfected, and filled with calcium hydroxide paste, which was left in place for 7 days. At the third visit, calcium hydroxide was removed with hand files and passive ultrasonic irrigation, and the canal was filled with a mixture of double antibiotic paste (metronidazole/ciprofloxacin) and zinc oxide. The antibiotic paste was left in place for 30 days. At the final visit, the paste was removed and the periapical area stimulated with a #80 K-file to encourage clot formation within the pulp cavity. A mineral trioxide aggregate paste cervical plug was placed, and the tooth was restored with glass ionomer cement. Clinical and imaging (radiographic and tomographic) follow-up at 3, 6, 12, and 36 months showed endodontic success with continued root formation. *(J Endod 2017;■:1–4)*

Key Words

Avulsion, immature permanent tooth, intentional replantation, regenerative endodontics

Significance

This case report demonstrates the importance of clinical inspection and imaging to establish a complete and correct diagnosis and treatment in regenerative endodontics.

In recent decades, great strides have been made in the treatment of infected immature teeth. This has created much more promising treatment perspectives for patients, including the possibility of complete root formation, through techniques known as regenerative endodontic therapy (1–3).

Dental trauma is 1 of the leading causes of pulp necrosis in immature teeth (4). Epidemiological studies have shown that approximately 1 in 2 children will sustain dental trauma, with boys and those aged 7–12 years being most commonly affected (5–7). Dental injuries may be associated with several modes of tissue damage, including fracture, dislocation, intrusion, and avulsion (8).

Avulsion is characterized by complete displacement of the tooth from of its socket, severing all connections between the tooth and the alveolar bone (9). The prognosis and viability of dental papilla and periodontal ligament tissues are inversely proportional to the time spent out of the socket (ie, the extraoral period) (10).

The supporting periodontium and root dentin constitute a complex of closely physiologically related cell types, which include apical papilla, dental follicle, Hertwig epithelial root sheath, and alveolar bone marrow cells (11). This proximity and interaction contribute to root development and the formation of supporting periodontium (11).

Necrosis of the dental papilla causes cessation of rhizogenesis, which may lead to thin dentin walls (12). The thin dentin found in immature teeth is a hindrance to disinfection procedures, which are largely limited to irrigation and intracanal medicaments (13). In this setting, ultrasound techniques, particularly passive ultrasonic irrigation (PUI), have been proven to be an excellent alternative to enhance cleaning of root canal walls and remove bacterial biofilm without causing dentin wear (14).

Despite high success rates for apical lesion repair, the use of calcium hydroxide as an intervisit medicament and, more recently, mineral trioxide aggregate (MTA) apical plugs (15, 16) is associated with a high incidence of root fracture because of arrest of root formation and, consequently, reduced root dentin thickness (17).

The use of compounded antibiotic pastes (eg, triple antibiotic paste) for the treatment of pulp necrosis in immature teeth was first proposed in the early 2000s (18) and has since become widespread (19); new mixtures and combinations (eg, double antibiotic paste) have since been developed on the basis of clinical findings and microbiological research (20). The objective of antibiotic paste administration is to eliminate endodontic infection (21). Once infection is cleared, one can then stimulate clot formation within the pulp cavity; this, in turn, will promote the generation of new tissue through a form of genetic memory, which is needed to continue

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root formation (22, 23). This clot must be protected and provided with a scaffold to allow anchorage of coronal restoration material. Given its physicochemical and biological properties, MTA is particularly appropriate for this role (24, 25).

The present case reports the treatment of an avulsed immature maxillary right permanent central incisor in a 7-year-old child that was originally replanted in an inappropriate fashion. Treatment consisted of careful extraction of the tooth, alveolar socket preparation, and immediate replantation. Because of the presence of pulp necrosis, endodontic therapy, based on the contemporary tenets of pulp regeneration, was then performed.

Case Presentation

A 7-year-old child sustained a dental injury with avulsion of the maxillary right permanent central incisor. The child's mother immediately collected the tooth from the floor, rinsed it in running water, stored it in a water-filled container, and proceeded to the nearest dental clinic. The patient was seen by a dentist within 10 minutes of the injury, and the tooth was replanted. A splint supported on the maxillary right deciduous lateral incisor was also placed. The mother was instructed as to the need for tetanus immunization, and the child was prescribed an antibiotic to prevent local infection.

Seven days later, the mother and child sought care at the University of Fortaleza School of Dentistry Clinic, Fortaleza, Ceará, Brazil, because of extrusion and hypermobility of the maxillary right permanent central incisor. An intraoral examination revealed a poorly positioned, extruded tooth splinted inappropriately on the maxillary right deciduous lateral incisor. Plain radiography and cone-beam computed tomographic (CBCT) imaging (Fig. 1*A–D*) confirmed dental extrusion requiring proper repositioning within the alveolar socket and placement of an adequate splint supported by several adjacent teeth. The pulp of the injured tooth was unresponsive to thermal testing.

The images obtained were used to plan and execute a safe and judicious re-extraction of the tooth without touching the root surface. This was followed by curettage of the alveolar socket to remove any clots that might prevent proper fit within the alveolar bone and immediate replantation with as little injury as possible to the periodontal ligament and remaining dental papilla. A semirigid orthodontic wire splint spanning the maxillary teeth (the right deciduous first molar to the left deciduous first molar) was placed (Fig. 2*A–C*).

At the 7-day follow-up, there was excellent local healing. The splint was removed at the 14-day follow-up, and thermal pulp sensitivity testing was repeated. Again, there was no response, confirming the diagnosis of pulp necrosis.

Thus, regenerative endodontic treatment was begun. Under local anesthesia, access was established, and the root canal was located and prepared with hand files (sizes 90–140; Dentsply Maillefer, Ballaigues, Switzerland) to the radiographic working length (1 mm short of the root apex) while avoiding dentin wear. The canal was gently irrigated with 2.5% sodium hypochlorite solution to remove tissue debris and achieve local disinfection. A PUI system (E1-Irrisonic; Helse Dental Technology, Santa Rosa do Viterbo, Brazil) was used to enhance canal cleaning. The dentin walls were then rinsed with 17% EDTA, also under ultrasound activation, for 20 seconds. The canal was then irrigated with fresh EDTA solution, which was left in place for 4 minutes. At the end of these procedures, the canal was irrigated copiously with saline solution; dried with paper points; and filled with calcium hydroxide paste in saline, which was left in place for 7 days. The access cavity was restored provisionally with IRM caulk (Dentsply Indústria e Comércio Ltda, Petrópolis, Brazil).

At the second visit, after the absence of clinical signs and symptoms (pain, swelling, and fistula) was confirmed, the tooth was accessed again and the irrigation procedures repeated to remove the intracanal medicaments. After drying with paper points, the root canal was filled to the cementoenamel junction (CEJ) with double antibiotic paste (ie, a mixture of metronidazole [Flagyl 400; Sanofi-Aventis Farmacêutica Ltda, São Paulo, Brazil] and ciprofloxacin [Cipro 500, Bayer Schering Pharma AG, Leverkusen, Germany], 1:1 ratio) in zinc oxide. Again, the access cavity was sealed provisionally with IRM.

The intracanal medicament was left in place for 30 days and then removed as described previously. A #80 K-file was applied to the periapical tissue to cause bleeding and encourage clot formation within the canal. Finally, a white MTA paste (Angelus, Londrina, PR, Brazil) cervical plug was placed below the CEJ. Glass ionomer cement (Vitremer; 3M ESPE, 3M Dental Products, Irvine, CA) was used for the definitive restoration (Fig. 3*A–D*).

On clinical and radiographic follow-up at 1, 3, 6, 12, and 36 months, there was no evidence of pain, swelling, or fistula, thus confirming treatment success. CBCT scans obtained at the 1-year and 3-year follow-up revealed progression of root development (Figs. 3 and 4*A* and *B*). No tooth discoloration was observed in this case (Fig. 4).

Discussion

Endodontic treatment of teeth with incomplete root development is beset by challenges (1, 26). These challenges are even greater when teeth in the earlier stages of root formation are subjected to aggressive traumas, such as avulsion, and pulp necrosis occurs as a consequence.

In the case reported herein, although the avulsed tooth was replanted in an improper position and improperly splinted, this immediate replantation allowed the periodontal ligament tissues to remain viable. This helped prevent root resorption and allowed induction of root formation. To do so, we used intracanal medicaments to eliminate any infection

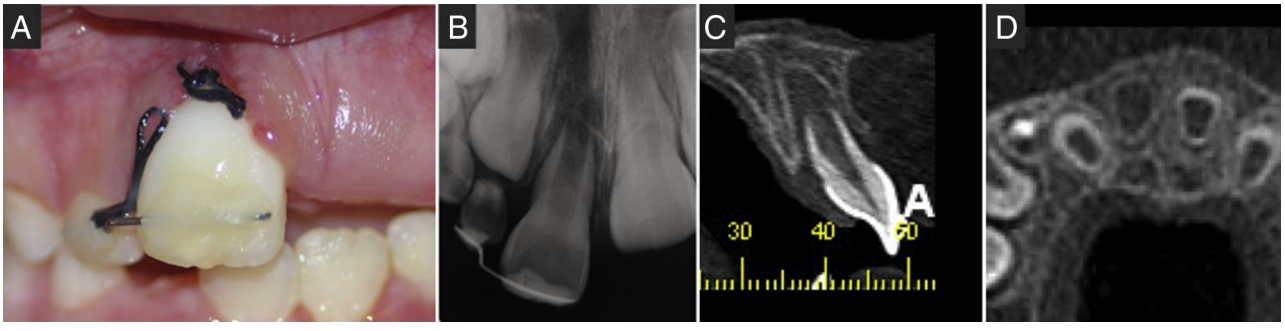

Figure 1. Initial appearance of the maxillary right central incisor showing clear malpositioning after replantation: (*A*) intraoral appearance; (*B*) baseline radiographs; and CBCT scans, (*C*) transverse and (*D*) axial views.