Revitalization Procedures in Two Traumatized Incisors with Different Biological Outcomes

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Abstract

Introduction: The revitalization of a previously necrotic pulp space has been shown to be possible and even considered predictable. However, exact criteria for success are still lacking, and, in fact, some cases do not respond as predicted. **Methods:** In this case, the same operator treated 2 teeth similarly according to the principles laid out by Banch and Trope. The tooth that according to our expectations was more likely to be revitalized successfully failed to do so, whereas the second tooth that, in our estimation, was less likely to succeed was successful. In the tooth that failed to revitalize, auto-apexification occurred. **Conclusions:** Complete understanding for the criteria for predictable revitalization and apexification is still lacking. *(J Endod 2012;38:411–414)*

Key Words

Apexification, pulp, revascularization, revitalization

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The revitalization of immature teeth with necrotic infected pulps and apical periodontitis has been shown to be possible and even predictable (1–5). The procedure requires disinfection of the pulp space with an effective antibacterial regimen commonly with the use of a bi- or triantibiotic paste (6, 7), the production of a scaffold into the pulp space (usually by means of a blood clot), and the placement of a bacterial tight restoration above the root canal (1).

This case report describes the treatment of 2 nonvital immature teeth with infected pulp spaces as a result of trauma. The same operator treated both teeth similarly. In one tooth, the procedure was successful in revitalization and continued root thickening and closure of the apex. In the adjacent tooth that in fact appeared preoperatively more likely to succeed, revitalization of the pulp space was unsuccessful. However, the disinfection protocol was successful in that the apical inflammation resolved and auto-apexification resulted.

Case Report

An 8-year-old boy was referred to Dr Lenzi for root canal treatment on the upper left and right maxillary central incisors. At presentation, both teeth had crowns with fractures from a fall at school (Fig. 1*G*). The reported accident had occurred 2.5 months previously, but he had not received any treatment. Medically, the child was under cardiac observation after a surgical repair for an interventricular communication at age 5. The surgery was successful, and the child was considered in very good health.

The physical examination revealed complicated crown fractures on the upper left maxillary incisor (ULI) and the upper right maxillary incisor (URI) (Fig. 1*G*). The URI appeared slightly infraoccluded with a suspected intrusive injury in addition to the crown fracture. The teeth were asymptomatic with no signs of acute infection, swelling, or sinus tract. The patient had no symptoms. Both teeth tested nonvital to cold and electric pulp tests. Palpation, percussion, and periodontal probing were all within normal limits.

In the periapical radiograph (Fig. 1*A*), the URI showed a complicated crown fracture. The tooth appeared to be of normal width and length with a slightly open apex. The presence of an apical lesion was inconclusive from this radiograph. The ULI had thin dentinal walls with a wide-open apex, indicating that the tooth had become nonvital because of a previous accident although the child and parents denied any previous traumatic injury. There was a distinct radiolucency apically on this tooth.

A cone-beam computed tomography (CBCT) radiograph taken at the initial visit (Fig. 1*B–F*) showed that the URI incisor had normal development for the child's age, with the apex being almost closed. The tooth appeared slightly intruded. The ULI had arrested development, thin dentinal walls, and an extremely wide apical foramen. A large radiolucency was present, suggesting a long-standing root canal infection previous to the latest traumatic injury.

Treatment

Because of the patient's age and short attention span, the teeth were treated on different days but similarly as described later. The teeth were anesthetized and isolated with a rubber dam. Access was made, and the access cavities and surrounding rubber dam were disinfected with a 2% chlorhexidine rinse on a cotton swab.

For the URI, there was some minor bleeding around the apex of the tooth, and care was made not to disturb any vital tissue in the apical part of the root. For the ULI, serous fluid was present in the canal with no apparent bleeding in the canal. A working length

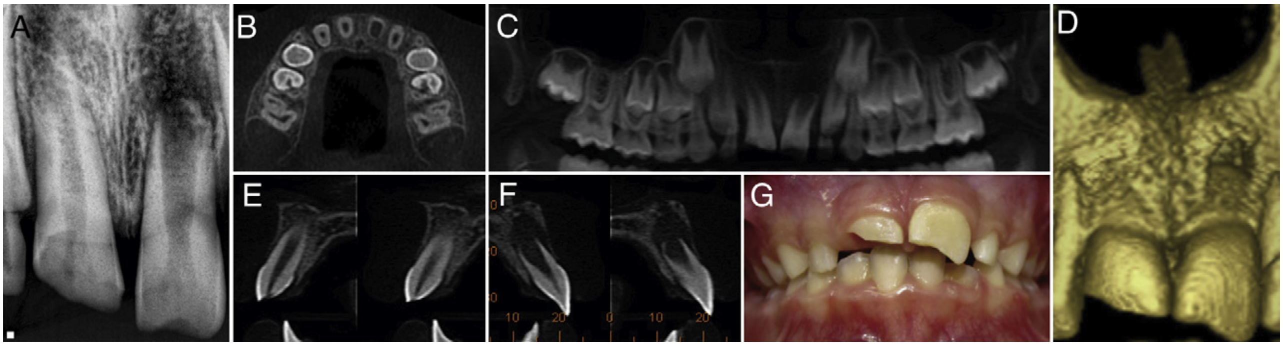

Figure 1. Clinical and radiographic appearances at presentation. (*A*) The periapical view showing the URI and ULI. URI shows a tooth with normal stage of development with apparent complicated crown fracture. ULI shows an immature root development, an open apex, and a large radiolucency. (*B*) The CBCT view in cross-section shows that the ULI is around the normal stage of development, but the URI stopped development much earlier. (*C*) A panoramic view confirming the findings in *A* and *B*. (*D*) The 3-dimensional view of the fractured incisors. (*E*) A CBCT sagittal view indicating the relatively normal stage of development for ULI, whereas (*F*) shows that the URI is not developed and shows a distinct radiolucency on the tooth. (*G*) A clinical view of both incisor teeth.

was determined with a periapical radiograph with the use of a #35 Hedstrom file (Dentsply/ Maillefer, Petrópolis, Rio de Janeiro, Brazil) in the canal.

The canal was gently irrigated with approximately 10 mL sodium hypochlorite 2.5% (Aspherical; Chemical Industry Ltd, São Paulo, Brazil) followed by a "wet" solution of antibiotics (minocycline 50 mg, ciprofloxacin 250 mg, and metronidazole 400 mg) diluted in saline. The canals were dried with large paper points until they were removed without evidence of fluid being removed and filled with a thicker mix of antibiotic paste with the same components of the antibiotic irrigating solution applied with a lentulo spiral filler. The coronal sealing was accomplished with the placement of a glass ionomer (Vitro Molar; DFL, Rio de Janeiro, Brazil).

After 35 days, the teeth were anesthetized, accessed, and irrigated with sterile saline. A blood clot was produced in both teeth by overinstrumenting the canals with an endodontic file. After sufficient time for the clot to coagulate, the coronal sealing was accomplished with the placement of white mineral trioxide aggregate (MTA Angelus; Angelus, Londrina, Brazil) covered with a photo-polymerized bonded resin restoration (3M ESPE, São Paulo, Brazil).

Follow-up

All follow-up included standard clinical tests, and radiographic examinations were performed with a CBCT scan and compared with the preoperative CBCT view. Periapical radiographs were also taken and compared with each other and with the CBCT views. Both teeth failed to respond to thermal and electrical stimulation throughout the follow-up period.

At the 4-month follow-up examination, the patient was asymptomatic. Radiographically, there was a slight indication that the walls on the URI were thickening (Fig. 2*C*). The ULI walls showed no indication of thickening, but there was a dramatic decrease in the size of the apical radiolucency (Fig. 2*D*).

At the 11-month follow-up, the patient remained asymptomatic. Revitalization of the root canal was performed if the URI was obvious with a distinct thickening of the dentinal walls and closure of the apex of the root (Fig. 2*E*). For the ULI, no evidence of revitalization could be seen. At this point, the apical radiolucency had resolved completely, and a distinct radiopaque barrier was seen at the apical opening, suggesting the formation of a hard-tissue barrier similar to that seen after a successful apexification procedure (Fig. 2*F*).

At 21 months, the patient remained asymptomatic. Successful revitalization of the URI was obvious (Fig. 2*G*) as was the fact that the ULI had not revitalized. The radiopaque hard-tissue barrier at the apex of the ULI was even more distinct (Fig. 2*H*). Figure 3 contrasts the preoperative presentation of the teeth and the 21-month presentation.

Discussion

The procedure attempted in this case report is better known as a revascularization procedure. The term *revascularization* suggests that the blood supply to the previously necrotic pulp space has been restored. This assumption is correct because if the canal wall thickens and the apex closes a blood supply is required. The authors prefer the term *revitalization* because the new tissue within the pulp space although not necessarily pulp does not comprise only blood vessels. It comprises (vital) cells that are required to lay down the new tissue. Therefore, the pulp space is filled with a connective tissue of some type, and this tissue is vital. Therefore, we believe that *revitalized* tissue is a more accurate term than *revascularized*. Because we know the tissue is not necessarily pulp tissue (3), we cannot use the term *regeneration*. However, the generic term *revitalization* seems most appropriate than *revascularization* because it describes a nonspecific vital tissue and not only blood vessels.

The revitalization of previously infected pulp spaces in immature teeth is a relatively common procedure today, and these appear to be ideal cases with a good chance of a successful outcome. Of the 2 cases, the ULI appeared more suitable for successful revitalization because the apex was so wide. According to Kling et al (8), the wider the apical foramen and the shorter the tooth, the more likely that the procedure will succeed. The URI was at the lower limit of suitability with an apical foramen close to 1 mm.

The same operator performed the procedures according to the principles (ie, disinfection, blood clot scaffold, and bacteria tight coronal seal) of Banchs and Trope (1) and URI responded as expected. This case can now be added to the lengthening list of successful cases (1–5). The response of the ULI with successful apexification without revitalization of the root canal was unexpected, and it is interesting to speculate as to why this response was seen.

In our mind, the most likely explanation is that the blood clot broke down, leaving an empty space with no scaffold into which the new vital tissue could grow. The production and maintenance of the blood clot are extremely difficult in revitalization procedures and appear to be its weak point. The volume of the blood clot may have been too great for it to maintain its physical structure. If it disintegrated, the pulp space would be left empty, thus not providing the necessary scaffold for the replacement vital tissue to move coronally. A synthetic