Regenerative Treatment of a Trauma-Induced Necrotic Immature Tooth

A Case Report

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Abstract

Apexification techniques for immature, necrotic teeth offer high levels of success; however, an alternative therapy may consist of regeneration in which the necrotic pulp tissue is removed and replaced with vital pulp tissue to promote further physiological development. This case report describes the treatment of a trauma-induced necrotic, immature, permanent central incisor by a regenerative approach instead of the conventional apexification technique. After the diagnosis of necrosis with asymptomatic apical periodontitis, the tooth was accessed and purulent drainage noted. The canal was disinfected with copious amounts of sodium hypochlorite. An interim treatment of calcium hydroxide, followed by a mixture of a triple antibiotic paste was placed. After 8 weeks the periapical tissue was mechanically stimulated to induce intracanal bleeding allowing a blood clot to form up to the level of the cementso-enamel junction. Mineral trioxide aggregate was subsequently placed coronally up to the level of the blood clot followed by a 6 mm seal of Cavit. After three months, both clinical and radiographic examination showed evidence of healing of the periapical lesion along with in-growth of potential cementum, bone, or dentin-like material. Mechanical instrumentation, an important part of routine RCT, cannot be performed in immature teeth though this tooth presented with a large periapical lesion, some vital tissue and Hertwig’s epithelial sheath possibly remained. Therefore, when the canal was disinfected and the inflammatory conditions reversed, these tissues were able to proliferate. Traditional treatment for immature teeth with a necrotic pulp does not promote further physiological development. This protocol initiates the induction of new vital tissue within the canal system. Vital tissue can provide thickening and consequent strengthening of the root canal walls. This tissue, however, has been reported to be more comparable to periodontal ligament than to pulpal tissue. Regenerative endodontics is a biologically based procedure designed to replace damaged dentin and root structures, as well as cells of the pulp-dentin complex, by comprising research in adult stem root structures, as well as cells of the pulp-dentin complex, by comprising research in adult stem cell history was unremarkable. The patient reported falling on the ice several years prior and needed to

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A 15-year-old female was referred from Private Practice to the Graduate Endodontics Department at the Indiana University School of Dentistry for evaluation and treatment of tooth #25. The medical history was unremarkable. The patient reported falling on the ice several years prior and needed to see a dentist to “fix a chipped tooth.” The clinical examination revealed no swelling, lymphadenopathy, or other significant findings extrinsically. Internally, no erythema, swelling, or sinus tract was noted. The patient was asymptomatic and the initial pulpal/periapical evaluation (Figure 1) revealed no cold or electric pulpal response with tooth #25. Periodontal probing was within normal limits for all mandibular anterior teeth. Radiographic examination revealed a periapical radiolucency associated with tooth #25 (Figure 2), adequate bone levels, intact PDL, and apical root reformation with an immature/open apex. A diagnosis of necrosis with asymptomatic apical periodontitis was made. Treatment options were discussed with the patient and legal guardian, and informed consent was obtained. Under local anesthesia and rubber dam isolation, an access cavity (Figure 4), confirming a canal measurement of 17.5 mm. An irrigation needle was placed to within 1 ml flush of sterile saline. Calcium hydroxide paste was placed within the canal with a Lentulo spiral, and the access cavity was sealed with a sterile sponge, Cavit, and IRM (Figure 5). The patient returned, asymptomatic, at the 3 month recall. Pulpal/periapical evaluation was performed (Figure 9) and revealed tooth #25 responded vital to cold, electric, and direct cavity stimulation. Radiographic examination showed evidence of healing of the periapical lesion along with in-growth of hard tissue (bone, dentin, cementum) formation within the canal (Figure 7). Cavit was replaced with a composite resin restoration (Figure 8). The patient was then placed on a 3 month recall.

Discussion

There are three main components of tissue engineering concepts in regenerative endodontics. The first component is a reliable cell source, capable of differentiating. This case report focused on the stem cells of the apical papilla. The second component is a physical scaffold to provide a physiochemical and biological micro-environment for cell growth and differentiation, promoting cell adhesion, and migration. The blood clot in this protocol served as this scaffold, and also provided a source of growth factors to facilitate the regeneration and repair of tissues. The third component is signaling molecules to stimulate cellular proliferation and directing cellular differentiation.

Mechanical instrumentation, an important part of routine RCT, cannot be performed in immature teeth because of the thin dentinal canal walls. Therefore, the disinfection relies solely on irrigation solutions such as NaOCl and intracanal medicaments such as Ca(OH)2 and the triple antibiotic mixture. Many tissues, including pulp tissue, are capable of regeneration and repair if given a condition free of infection. The triple antibiotic mixture has used high efficacy in reducing bacteria in infected root canals. A study by Windley et al.4 showed that an intracanal delivery of a 20-mg/ml solution of these three antibiotics at a Lentaloop resulted in a greater than 99% reduction in mean CFU levels with roughly 75% of the root canal system having no cultivable microorganisms present. Even though this tooth presented with a large periapical lesion, some vital tissue and Hertwig’s epithelial sheath might possibly remained. Therefore, when the canal was disinfected and the inflammatory conditions reversed, these tissues were able to proliferate.

References