

A REVITALIZATION PROTOCOL LEAD TO DIFFERENT OUTCOMES IN ADJACENT TEETH

ABSTRACT

Regenerative Endodontic Procedures can be defined as biologically based procedures designed to replace damaged structures including dentin and cells of the pulp – dentin complex. The term revascularization is more commonly employed with regenerative procedures and describes reintroduction of vasculature in the root canal system. This case report describes the treatment of two nonvital immature teeth with infected pulp. Revitalization was attempted in two adjacent teeth by the same operator following similar protocol. In one of the teeth, revitalization was successful with continued root wall thickening, root lengthening and closure of the apex whereas in the adjacent tooth though root lengthening could not be achieved, a definite apical closure with irregular root wall thickening could be obtained.

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KEYWORDS

Revitalization. Regenerative endodontic procedures.
Dentin complex.

INTRODUCTION

Currently, for immature permanent teeth with infected pulp, regenerative endodontic procedure is the preferred treatment modality. Regenerative Endodontic Procedures can be defined as biologically based procedures designed to replace damaged structures including dentin and cells of the pulp-dentin complex.¹ It leads to increased root wall thickness, increased root length and narrowing of the canal apically leading to the formation of an apex.²

Though the aim of the procedure is to attain an organized repair of the dental pulp, to what extent the regeneration of the pulp dentin complex actually occurs is not clear as yet.

The term revascularization is more commonly employed with regenerative procedures and describes reintroduction of vasculature in the root canal system.³ But the pulp space does not contain only blood vessels. It also contains cells which are required to lay down new vital tissues. Few case reports where histological studies have been carried out have found pulp like loose connective tissue in the pulp space and ingrowth of vital tissues resembling cementum, PDL and bone from the apical end of the tooth.⁴ Revitalization is a more appropriate term in such cases as it encompasses both- development of new vasculature as well as new vital tissues in the pulp space.²

The reported outcomes from case reports in various literatures showing continued root development after revitalization/regeneration procedures are variable. The success of a case depends on multiple factors which have not been analyzed successfully till date.

This case report describes the treatment of two nonvital immature teeth with infected pulp. Revitalization was attempted in two adjacent teeth by the same operator following similar protocol. In one of the teeth, revitalization was successful with continued root wall thickening, root lengthening and closure of the apex whereas in the adjacent tooth though root lengthening could not be achieved, a definite apical closure with irregular root wall thickening could be obtained.

CASE REPORT

An 8-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Ahmedabad, Gujarat, India with a complaint of pain in upper left front teeth since past one month with a history of trauma 6 months ago. Prior to his visit to the college, he had received incomplete dental treatment by another local dentist.

On clinical examination upper left central and lateral incisors were found to be tender on percussion and had root canal access

openings done which were filled with eugenol containing temporary cement. There was a draining sinus in the labial vestibule just above the apex of the upper left central incisor. There was no complain of swelling and periodontal probing was within normal limits. Vitality tests with Electrical Pulp tester (Parkell) were inconclusive, probably because either the teeth were not fully developed or were necrosed.

Periapical radiographic examination (Figure 1) revealed that the upper left central and lateral incisors had open apices and their root lengths were shorter than the adjacent central incisor. The presence of any apical lesion was inconclusive from the radiographs. There was no obturation in the root canals. The diagnosis of necrotic pulp with chronic apical abscess for maxillary left central incisor and necrotic pulp with symptomatic apical periodontitis for the maxillary left lateral incisor was made and revitalization protocol was planned.

In the first visit access opening was refined, canals cleaned with minimum filing and irrigated with 2.5% sodium hypochlorite (Neelkanth, India). Triple antibiotic paste (TAP) (minocycline 50mg, ciprofloxacin 250mg, and metronidazole 400mg diluted in saline) was given as intracanal medicament with the help of files and pluggers and left in the canal for 14 days. In the second visit, the dressing was removed, root canals were irrigated with sterile saline, canals were dried

and bleeding induced in the canal with the help of a sterile needle. Then MTA (ProRoot, Dentsply) was packed in the coronal third, over which moist cotton pellet was placed and access was sealed with IRM. Patient was recalled the next day, the moist cotton pellet and IRM were replaced by glass ionomer cement (GC FUJI 2) (Figure 2).

Figure 1. Pre operative radiograph.

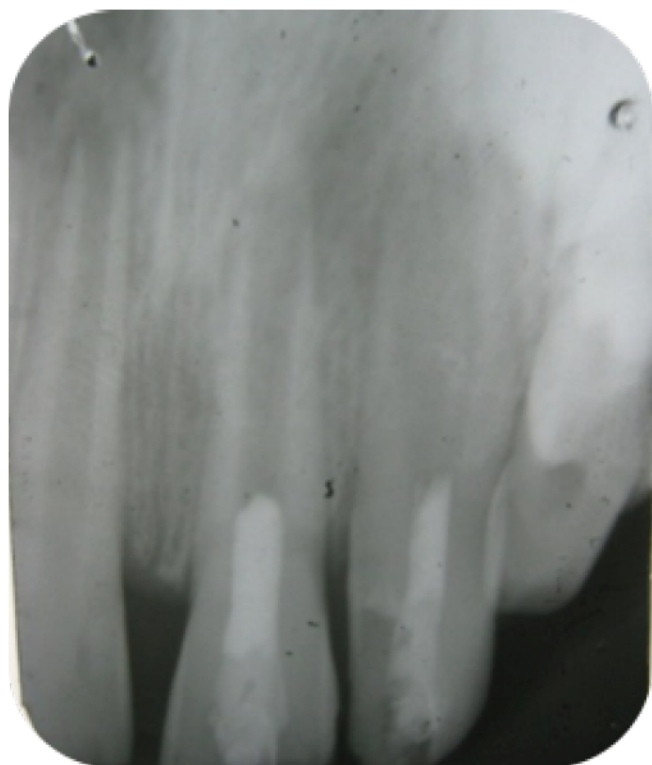


Both central and lateral incisors show incomplete root formation and immature apex.

Recall radiograph after 18 months showed that in case of central incisor the root length did not increase but definite apical stop with irregular thickening of lateral dentinal wall in the apical third could be seen with no periradicular radiolucency at the apex (Figure 3). In case of the lateral incisor, definite apexogenesis with lengthening of root, thickening of dentin wall, narrowing of apical foramina, formation of lamina dura and formation of apical periodontal ligament were

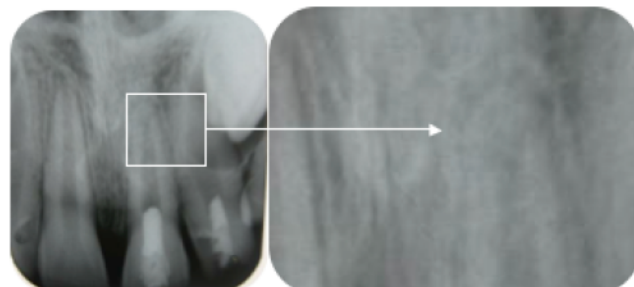
seen. Both the incisors were asymptomatic but unresponsive to electric pulp testing (Figure 4).

Figure 2. After revascularization protocol.



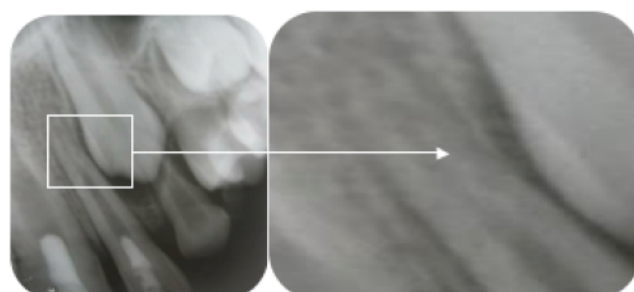
the same, the local microenvironment for both the cases varied which seems to have played an important role in determining the outcome of the procedure.

Figure 3. Recall radiograph at 18 months.



Left central incisor doesn't show root lengthening but a definite apical stop can be seen.

Figure 4. Recall radiograph at 18 months.



Left Lateral incisor shows root lengthening and thickening of walls and apexogenesis.

DISCUSSION

Outcome of a regenerative procedure depends on multiple factors. To name a few, they are the age of the patient, type and duration of the infection, the systemic factors of the host, size of the apical foramen, the pulp/root length, local regeneration activating signals, etc.^{1,5}

In this case, in both the teeth the systemic host factors were same and the same operator performed the procedures. But the two teeth showed different outcomes implying that although the systemic factors remained

According to Kling et al⁵ wider the apical foramen and shorter the tooth, more likely that the procedure will succeed. Thus, the lateral incisor was more suitable for successful revitalization because it had a wider apical foramen and a shorter root/pulp length as compared to the central incisor.

The response of the central incisor with successful apexification without root lengthening was not anticipated, and it

becomes interesting to figure out as to why this response was seen.

The most likely explanation is that the central incisor had a draining sinus suggesting a chronic periradicular infection which was absent in the case of the lateral incisor. Also, the central incisor was in its later stage of root development indicating a longer root/pulp length as compared to the lateral incisor, which is less likely to promote root growth.⁵

The chances of survival of stem cells in periapical tissues decreases with the increasing duration of the periradicular infection; thus leading to the lack of pulp regeneration and poor root development in such cases.

This longstanding infection can destroy the cells capable of revitalization namely, stem cells of apical papilla (SCAP), dental pulp stem cells (DPSC), periodontal ligament stem cells (PDLs), dental follicle precursor cells (DFPCs) and cells of Hertwigs Epithelial Root Sheath (HERS) which migrate in response to the signals by the endothelial cells and the growth factors (VEGF, FGF-2). A hostile microenvironment in the apical area may be created which adversely affects growth factor secretion and hence influencing the progenitor cell differentiation into cells of the pulp-dentin complex.

However, this hypothesis may also appear unlikely in that many cases have been published with successful revitalization in

which root canal infection was of a long standing nature.

But interestingly, auto apexification resulted in the central incisor. Normally apexification requires a very low bacterial load in the root canal space to form a hard tissue barrier; possible explanation in the case of the central incisor is that intracanal application of TAP sterilized the canal to an extent that it favored apexification.

Human stem cell markers have been shown to be in significantly higher concentrations in the blood clot induced inside the root canal space as compared to the peripheral blood.⁶ The other explanations that can be given for the failure of revitalization in the central incisor may be either insufficient bleeding induced or disintegration of the blood clot leading to loss of scaffold onto which vital tissue can grow.⁷

In such cases, a cell based approach to revitalization or a synthetic scaffold incorporating antibiotics and growth factors with a suitable delivery system for continuous release may have improved the predictability of the procedure in relation to the central incisor.

The two teeth did not respond to electrical pulp tester implying lack of innervations of the pulp space with formation of some kind of nonspecific vital tissue.

Though the current case did not achieve a conclusive positive vitality response at the 18

month follow up appointment, it is possible that on longer periods of evaluation, the teeth may generate a positive response.^{7,8}

It can be said that the current information on the factors responsible for successful regenerative endodontic treatment is scarce and the outcome of the regenerative/revitalization procedure is not predictable and needs to be researched further.

CONCLUSION

Regeneration of tissue in a necrotic infected tooth has been thought until now to be impossible. However, if it were possible to create favorable environment for growth of tissue, regeneration should occur. With the current knowledge, the predictability of regeneration procedures is limited; however it can be explored with huge sample sizes.

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