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Regenerative Treatment Of An Immature Non Vital Permanent Incisor Using Cgf - A Case Report

Research Article

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Abstract

Introduction: With the importance being given to conservative endodontic treatment, pulp revascularisation has received maximum attention as it provides promising results in immature teeth and can be practiced as an alternative to the conventional apexification procedure. This case report highlights the use of concentrated growth factor (CGF), an autologous platelet concentrate as an effective material in the healing of the bony defect as well as regeneration of the immature tooth.
Symptoms Of The Patient and Clinical Findings: This report discusses the case of a 24 year old male patient who reported with discoloration and occasional pain in the upper anterior tooth.
Diagnosis and Intervention: It was diagnosed with open apex in 21 and apical periodontitis in 21 and 22. Revascularisation therapy was planned with the use of CGF as a scaffold.

Keywords: Open Apex; Immature Tooth; Triple Antibiotic Paste; Revascularisation; Concentrated Growth Factor.

Introduction

Regenerative endodontics refers to biologically based procedures that are designed to regenerate dentin, root structure as well as cells of the pulp dentin complex [1]. Traditionally root canal treatment is planned for cases of irreversible pulpitis or apical periodontitis, which not only results in complete removal of pulp but also loss of proprioception along with cessation of root development in young patients [2, 3]. Moreover, it is difficult to achieve apical seal with root canal treatment in open apex cases. In the recent past, apexification was used for the treatment of open apex cases which increased the risk of root fracture and failed to promote root development as well [4]. To overcome all these drawbacks, regenerative endodontic treatment came in to practice.

Regenerative endodontics requires three components-scaffolds, stem cells and growth factors [5]. Commonly used natural scaffolds include platelet concentrates that serve as a source of platelets, which on breakdown release excessive growth factors that are believed to cause stem cell mobilization, proliferation and differentiation resulting in rapid healing and regeneration [6].

Previously our team has a rich experience in working on various research projects across multiple disciplines [7-21] Now the growing trend in this area motivated us to pursue this project.

In this case report CGF is used as a scaffold which is a second generation platelet concentrate prepared from autologous blood sample using a special centrifuge which results in the formation of a denser fibrin matrix containing excessive growth factors [22,

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23].

De-identified patient specific information and chief complaint:

A 23 year old male patient reported to the department with the complaint of discoloration and occasional pain in the upper front teeth for 2 months.

Past History and Interventions:

Past dental history revealed a road traffic accident 10 years ago which involved the upper front teeth. The patient had not visited the dentist then as the teeth were asymptomatic. Patient developed pain in the upper front teeth a year ago during which treatment was initiated but left incomplete.

Clinical Examination:

Extraoral examination did not show any growth or swelling. On intra oral examination, discoloration was seen in 11 and 12 with mild tenderness to percussion (Figure 1). Access cavity preparation was seen with respect to 11 and 12. Electric pulp test showed no response in 11 and 12.

Radiographic Examination:

Radiographic examination revealed periapical radiolucency involving 11 and 12. Open apex was seen in 12 with Cvek Stage II of root development (Figure 2). CBCT was taken to evaluate the dimension of the open apex which was noted to be 3.06mm (Figure 3).

Diagnosis:

A diagnosis of Ellis Class IV trauma in 11 and 12 showing apical periodontitis with open apex in 12 (Cvek's Stage II of Root Development) was given. Non surgical root canal therapy was planned for 11 and revascularization for 12.

Patient's consent was taken before starting the procedure.

Therapeutic Intervention

In the first appointment, access was reestablished under local anesthesia and rubber dam isolation. Working length was determined. The canal of 12 was disinfected with 20ml of 1.5% of sodium hypochlorite followed by saline using side vented needles inserted 1 mm short of the apex. The canal was dried with paper points and calcium hydroxide was placed as an intracanal medicament. The access was closed with zinc oxide eugenol. The canal of 11 was disinfected with 3% sodium hypochlorite and cleaning and shaping was done upto file no 50. Intracanal calcium hydroxide was placed and temporary restoration of zinc oxide was given.

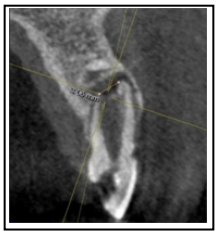
The patient was recalled after 1 week for the second appointment. On examination, 12 was symptomatic. The access to 12 was reestablished and discharge was seen from the canal. The disinfection protocol followed in the first appointment was repeated and intracanal calcium hydroxide was placed followed by temporary restoration with zinc oxide eugenol. For 11, the intracanal medicament was washed away using saline and the canal was obturated with lateral condensation technique using resin sealer.

Patient was recalled after a week for the third appointment. Examination revealed asymptomatic 12. The tooth was anesthetized

Figure 1. Pre operative clinical photograph.

Figure 2. Pre operative radiograph.

Figure 3. Pre operative CBCT.



with local anesthetic without vasoconstrictor, the tooth was isolated and the access was established. Canal was irrigated with saline to wash off the calcium hydroxide followed by irrigation with 20ml of 17% EDTA. The canal was dried with paper points. Bleeding was induced in the canal by over instrumentation with 35 no. K file (Figure 4). Meanwhile the patient's blood was collected for the preparation of CGF. After CGF was prepared in Medifuge, it was cut in to pieces and packed into the canal (Figure 5). White MTA was mixed and used as a barrier over the CGF. Radiograph was taken to assess the level of MTA followed by restoration of the access with glass ionomer cement (figure 6).

Follow up:

The patient was followed up at 3, 6 and 12 months. Intraoral radiographs were studied at 3 and 6 months intervals in anticipation of a successful regenerative procedure. 1 year follow up using radiograph showed no evident apical closure while CBCT showed formation of an apical barrier at the end with the apical diameter reduced to 2.18mm indicating success of regenerative procedure (Figure 7,8).

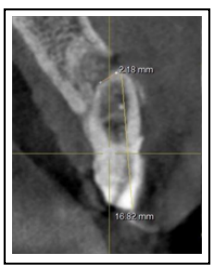
Figure 4. Bleeding induced in the root canal by overinstrumentation.

Figure 5. Placement of CGF within the root canal.

Figure 6. Post operative radiograph.

Figure 7. 1 year follow up radiograph.

Figure 8. 1 year follow up CBCT.



Discussion

It is difficult to treat immature teeth showing pulp necrosis and apical periodontitis due to the thin root canal walls and open apices [24]. To overcome such a problem, regenerative endodontic treatment was adopted that followed the principles of cell homing. This required the presence of a scaffold and the right concentration of growth factors. It has been reported earlier that bleeding induced for revascularization would help in stem cell migration from the apex along with platelet degradation to release growth factors. Since the concentration and composition of cells within the fibrin clot cannot be controlled, the outcome would also remain unpredictable. To have an optimum microenvironment for pulp regeneration, autologous platelet concentrate CGF was used in this case that served the source of sufficient quantity of growth factors for the regeneration process. The limitation of this process is that spatial and temporal release of growth factors cannot be controlled and the healing process would be more of a repair than regeneration [25-27].

For this case, the CGF was prepared using Medifuge which is an equipment with an in-built rotational speed, time and centrifugation protocol needed for the synthesis of CGF. The programme is designed such that the CGF synthesized is stronger with excess growth factors.

The most commonly used materials as scaffolds are PRF and CGF [28, 29]. CGF is preferred as it provides a stronger and thicker matrix with excess growth factors. The strong three dimensional network of fibrin provides slow release of growth factors [23]. A study conducted by Park et al shows more fibres per unit area in the fibrin matrix obtained from CGF when compared to PRF [30].

For regeneration to take place, the migration of stem cells is necessary. These stem cells are believed to reside in the apical papilla which is the source of odontoblasts during root development. The SCAP proliferates faster than the dental pulp stem cells and are believed to regenerate into dentin pulp complexes [31-34]. CGF is believed to stimulate the proliferation of SCAP by its abundant release of growth factors [24]. Yu B et al have also reported osteogenic differentiation of periodontal ligament stem cells by CGF [35]. Apart from providing a bundant growth factors, CGF also significantly improves proliferation, migration and differentiation of SCAP.

Our institution is passionate about high quality evidence based research and has excelled in various fields [36-46].

Conclusion

Looking in to the favorable effects of CGF as given in the literature, it can be used for more predictable periapical healing and regeneration of pulp dentin complexes. Due to the lack of highest evidence of success of CGF in regenerative endodontic procedures, further randomized controlled trials have to be conducted to understand the risks and benefits of such procedures.

Informed Consent

The patient was informed of the treatment protocol and was explained about the probable outcomes of this procedure. Patient's consent was taken before initiating the treatment.

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