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RESEARCH ARTICLE

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Regenerative endodontic management of an immature non vital permanent molar using concentrated growth factor- A Case Report

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ABSTRACT

BACKGROUND: Endodontic management of immature necrotic molar teeth has always been a challenge for clinicians. This case report highlights the use of concentrated growth factor, an autologous platelet concentrates as an effective bio-material in the regeneration of an immature tooth.
CASE DESCRIPTION: A 14-year-old girl reported to the dental office with pain in the lower left second molar. Revascularization procedure was carried out after obtaining parental consent. Following bleeding induction, CGF was prepared, placed, and condensed using pluggers in the root canal space, followed by the placement of mineral trioxide aggregate up to the level of CEJ. Entrance filling was then given with type IX GIC and the patient was followed up for 1 year. At the end of 1 year, the patient was devoid of pain and an increase in root canal thickness and length was seen.
CONCLUSION: Concentrated growth factor can be considered as an effective scaffold for regenerative treatment of immature necrotic teeth.
CLINICAL SIGNIFICANCE: Concentrated growth factor provides good cell proliferation and osteoblastic differentiation as well as a rich growth factor content. Revascularization process is quicker in this case considering the young age of the patient.
KEYWORDS- *Revascularization, immature tooth, open apex management, regenerative endodontics*

INTRODUCTION

Regenerative dentistry focuses on the regeneration of oral and dental tissues. It follows the triad of tissue engineering, by including cells, scaffolds and bioactive molecules. Cells could come from dental pulp stem cells , stem cells from exfoliated deciduous teeth , stem cells from apical papilla and periodontal ligament stem cells [1-2] . Scaffolds can be designed to carry appropriate cells, and to deliver signalling molecules to initiate tissue healing and bioactive molecules such as growth factors, genes and drugs, can be released by the scaffold, or delivered independently. Regenerative endodontics enables root development to continue, in contrast to artificial apical barrier techniques and apexification. The drawback of apexification techniques is that they prevent further root development, resulting in brittle root structure [3] . When determining which revascularization strategy is appropriate for a specific pulpal disease, case selection is crucial [4] . Attempts have been made over the years for repair and regeneration, incorporating well-known platelet concentrates such platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) [5] . In addition to traditional platelet concentrates, Concentrated growth factor (CGF) has been proposed as an appropriate biomaterial since it produces growth factors that promote angiogenesis and tissue remodelling, as well as cell migration and has a chemotactic effect on inflammatory cells. The production of CGF does not require additives and it is a simpler process when compared to platelet-rich plasma (PRP) [6] .

The novelty of this is the use of concentrated growth factor in promoting revascularisation in a young permanent molar. According to the clinical considerations of the American Association of Endodontists for regenerative endodontics [16] , the main goal of regenerative procedure is to eliminate clinical symptoms and resolve apical periodontitis if present. Primary goal of regeneration is to devoid the patient of signs and symptoms and evidence of bony healing. Secondary goal is increased root wall thickness and/or increased root length. Primary and secondary goals were achieved.

CASE DESCRIPTION

A teen aged girl reported to the Department of Pediatric and Preventive Dentistry with the chief complaint of decay and dull pain in left lower back tooth for the past two weeks. The child was accompanied by her mother for the visit. Her medical history was non-contributory and there was no history of any previous dental visit. No findings were noted in extra-oral examination. Intra-oral clinical examination revealed extensive caries in the lower left molar, radiographically revealed radiolucency involving enamel, dentin and pulp with a periapical lesion adjacent to the mesial and distal roots. On percussion there was pain in relation to the concerned tooth. Cold test was carried out using refrigerant spray (Coltene/Whaledent, Switzerland), and electric pulp testing (Gentle Pulse™ Pulp Vitality Tester, Parkell, USA) showed no response when compared with the control teeth. The periodontal status was healthy and the tooth showed no mobility.
Based on the clinical and radiographic examination the diagnosis was made as pulpal necrosis in lower left second molar with symptomatic apical periodontitis, and given the immaturity of the tooth, revascularization was our first and best course of action. After a

complete explanation of the treatment procedure, informed consent was obtained by the parent.

INVESTIGATIONS

The Radiographic evidence states radiolucency involving enamel, dentin and pulp with a periapical lesion adjacent to the mesial and distal roots. Cold test was carried out using refrigerant spray (Coltene/Whaledent, Switzerland), and electric pulp testing (Gentle Pulse™ Pulp Vitality Tester, Parkell, USA) showed no response when compared with the control teeth.

TREATMENT

Concentrated growth factor was prepared by drawing 10ml of intravenous blood samples and placing them in centrifuge tubes using an altered centrifugation technique. A standard, disposable, non-anticoagulant glass tubes and a matching centrifuge device (MEDIFUGE, Silfradent s.r.l., S. Sofia, Italy) were used. About 10 mL of intravenous blood was drawn from antecubital fossa of the patient and was placed in the centrifuge tubes without anticoagulants and accelerated for 30 s, centrifuged at 2700 rpm for 2 min, 2400 rpm for 4 min, 2700 rpm for 4 min and 3000 rpm for 3 min, and decelerated for 36 s to stop. This was performed by a licensed nurse.

The American Association of Endodontists protocol for regenerative endodontics was followed for the procedure [16] .

Local anaesthesia was administered (2% lidocaine without adrenaline), the tooth was isolated with a rubber dam, the pulp chamber was accessed, and the pulp was confirmed as necrotic. Copious, gentle irrigation with 20 ml of 1.5% sodium hypochlorite using a side-vented needle was done. This was done to prevent extrusion of irrigants into the periapical space due to the immature roots. After working length was measured, calcium hydroxide was placed in the root canals and a closed dressing was given. The patient was then followed up and asked to report for the second visit after three weeks. No adverse events were reported during the follow-up periods.

During the second visit, bleeding was induced by over-instrumenting (by rotating a pre-curved K-file at 2 mm past the apical foramen with the goal of having the entire canal filled with blood to the level of the cementoenamel junction). The CGF obtained was packed into the canals to the level of cementoenamel junction. 3 mm MTA (MTA Angelus Brazil) plug was placed at the level of CEJ, and the coronal cavity was sealed using GIC type IX.

OUTCOME AND FOLLOW UP

The patient was recalled after 4 weeks for follow up. Primary and Secondary goal of treatment was achieved after continuous follow up for 3,6 and 12 months where the patient was devoid of signs and symptoms and radiographs confirmed periapical healing of the lesion around the roots.

DISCUSSION

The emphasis of this report is revascularization in immature molars, which is made feasible by using the innovative autologous platelet concentrate (CGF), in accordance with the recommendations issued by the AAE. Biomechanical preparation or instrumentation should not be done for revascularization because the dentinal walls of the roots are so thin, any instrumentation weakens them and increases the risk of future breakage [4,8] . CGF was chosen as it was found to be more efficient in terms of cell proliferation and osteoblastic differentiation as well as having a higher growth factor content, CGF did actually outperform PRP and PRF as CGF contains more cytokines and growth factors as shown in previous literature and compared with PRP, CGF does not contain bovine thrombin and anticoagulants, which could have adverse effects such as cross-infection and immune rejection [9,10] .

In order to improve the predictability of regenerative endodontic operations, disinfection is crucial. It was found that compared to antibiotic pastes, calcium hydroxide disinfection increases the survival of SCAP cells [11,12] . In this case, in addition to the bleeding induced in the canals CGF was used in order to help the pulp-dentin complex formation as induced bleeding into the root canal space causes a higher concentration of mesenchymal stem cells from the apical papilla that may not be sufficient for regeneration to occur, hence additionally an autologous platelet concentrate scaffold is used. This scaffold acts as a growth factor reservoir and helps the regenerative process [13] . Case reports similar to the present case have favoured the use of autologous platelet concentrate in regeneration, but all the previous cases have only used PRP or PRF in molars [5,15] . PRP offers a benefit in that platelets can stimulate and draw stem cells found in apical lesions and apical tissue. PRF is a second-generation platelet concentrate which requires no biochemical handling of blood.

Several other studies have also reported regenerative endodontic treatment of necrotic immature teeth to result in less-than-ideal outcomes, including failure to increase root wall thickness. All of these drawbacks in the previous literature have been overcome in this study by the use of concentrated growth factor [4] .

The main challenge in the present case, was drawing blood for obtaining CGF considering the young age of the patient, which was crucial but on explaining the benefits and with the positive outcome of saving the tooth rather than extracting it, it was agreed upon and considered the best option.

CGF was used as the material of choice and appears to be promising for revascularization as it provides good cell proliferation and osteoblastic differentiation as well as a rich growth factor content and this was an ideal case selection as the young age of the patient would benefit the healing process and give good results.

Revascularization of immature necrotic permanent molar with concentrated growth factor has increased benefits and successful outcome, if case selection is ideal as the young age of the patient would benefit the healing process and give good results.

CLINICAL SIGNIFICANCE

C Concentrated growth factor (CGF) was used as the material of choice when compared to other autologous platelet concentrates Platelet rich plasma, PRP and Platelet rich fibrin, PRF as it provides good cell proliferation and osteoblastic differentiation as well as a rich growth factor content.

This treatment approach helps in physiologically strengthening the root walls of an immature tooth instead of the conventional apexification technique where an artificial apical barrier is made and apical sealing following conventional RCT is never guaranteed at the open apex of an immature tooth.

· Proper clinical and radiographic follow up is required in such cases which helps us evaluate the prognosis of the tooth.

CONCLUSION: Concentrated growth factor can be considered as an effective scaffold for regenerative treatment of immature necrotic teeth.

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FIGURES

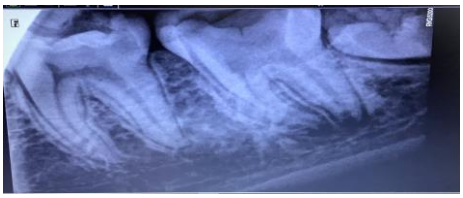

Fig 1: Pre-op radiograph, caries involving pulp irt 37 with periapical lesion around both roots.

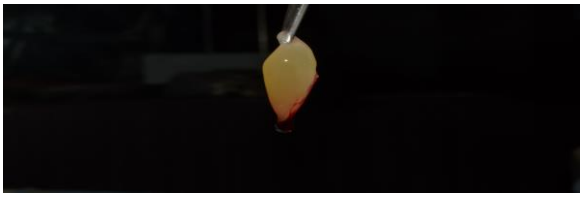

Fig 2: Concentrated growth factor (CGF) collected,centrifuged and prepared.

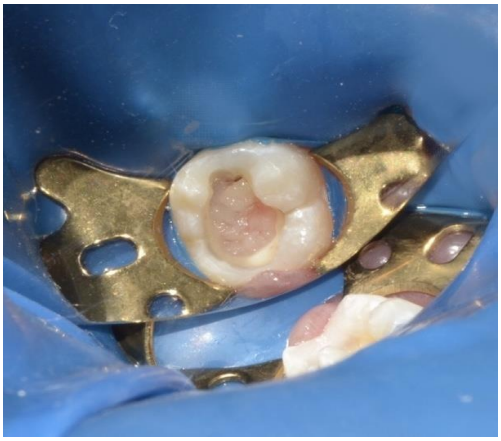

Fig 3: CGF condensed into the canals.

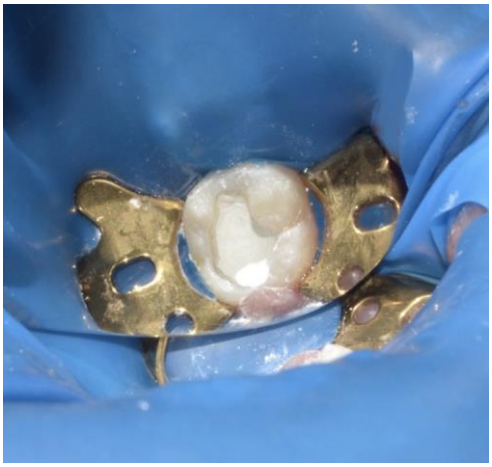

Fig 4: Placement of MTA at the level of CEJ.

Fig 5: Post op 1 year follow up radiograph showing healing of periapical lesion and increased root length.