



### **BRIDGING THE GAP – A PINNACLE IN ENDODONTIC THERAPY**

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#### **INTRODUCTION :**

The goal of regenerative endodontics is to keep the dentition in a physiologically functional state. Regenerative endodontic therapy has been defined as “biologically based procedures designed to replace damaged structures, including dentin and root structures, as well as cells of the pulp-dentin complex”<sup>1</sup>.

Trauma to the developing dentition results in developing risk for pulpal necrosis, which is dependent upon the type of dental trauma. The occurrence of pulpal necrosis was estimated to be 0% (infarction), 3% (concussion), 26% (extrusion), 58% (lateral luxation), 92% (avulsion), 94% (intrusion).<sup>5</sup> Incomplete root formation due to pulpal necrosis lead to premature loss of permanent teeth.<sup>2</sup> cleaning and shaping of large blunderbuss canals, obturation of canals with open apices poses a challenge. There is a potential for root fractures caused by thin and weakened root walls.<sup>3,4</sup>

The replacement of damaged and underdeveloped tooth structures with normal pulp-dentin complex is based on tissue engineering, which consists of triad of stem cells, signaling molecules, and scaffolds.



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Various terms used to describe the introduction of new living tissue into the canal space include regeneration, revascularization, and revitalization.

The term revascularization describes the re-establishment of the vascular supply to existing pulp in immature permanent teeth. Endodontic regeneration is the replacement of “damaged structures, including dentin and root structures, as well as cells of the pulp-dentin complex.”<sup>6</sup>

Principles of regenerative endodontic procedures involve - bacterial elimination from the root canal system, scaffold creation for the ingrowth of new tissue, creating a bacteria-tight seal to prevent reinfection.<sup>7</sup>

### **Case report :**

An 18-year-old male patient was referred to the Department of conservative dentistry and Endodontics, Srisai College of Dental College and Hospital with mild pain on chewing and localized swelling in the anterior region of maxilla. He has a history of trauma 10 years back. Medical history was non-contributory. On clinical examination 21 was tender on percussion and vitality for thermal test elicited no response in this tooth.

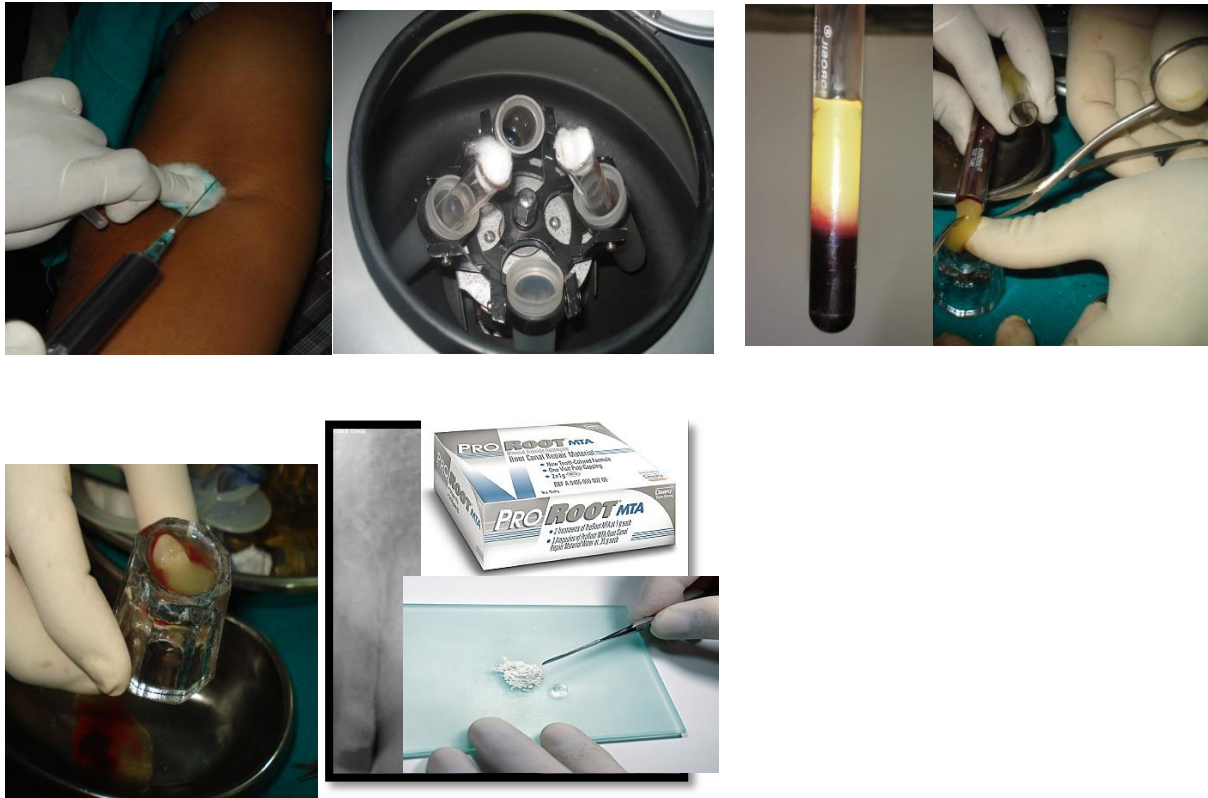
Radiographic examination revealed 21 with immature apices, and a periapical lesion. Based on clinical and radiographic examinations, diagnosis was pulpal necrosis. Considering the immaturity of the teeth, the first treatment option was regeneration.

Under local anesthesia with 2% Lidocaine and 1:800,000 epinephrine, an access cavity was prepared. Working length was estimated radiographically using a size #30 K-file. The canal was passively irrigated with 20mL of 5.25% NaOCl and gently dried with paper points. A mixture of equal proportions of ciprofloxacin, metronidazole and minocycline (Triple antibiotic paste) was placed in the root canal with a #30 K-file 3mm short of the radiographic apex. The access cavity was sealed temporarily with Cavit. After 3 weeks the patient was asymptomatic and localized swelling had resolved.



5 ml of whole blood was collected from the median cubital vein of the patient for the preparation of PRF clot. After rubber dam isolation and removal of Cavit dressing, antibiotic dressing material was removed by irrigating with 10 mL of 5.25% NaOCl and saline. The canal was then dried with paper points. A #40 K-file was passed beyond the apex to induce bleeding inside the canal. The PRF membrane was placed over the clot and MTA was used as a coronal barrier. A moistened cotton pellet was placed over MTA and the tooth was restored temporarily with Cavit. 24

hours post operatively permanent restoration was done. The patient was recalled at 3, 6, 9, 18, 24 months and 3 years.



### Follow-up :

Clinical examination post one month revealed no tenderness/pain to percussion/palpation. At 6 months, periodontal probing revealed reduction in pocket depth. There was resolution of an apical radiolucency at 18 months and at the end of 3 yrs there is increased length of root walls and apical closure.

0 Months

3 Months

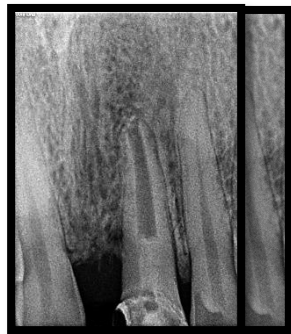
9Months



18 Months



3 years



### Discussion :

Regenerative procedure in immature teeth was introduced in the field of endodontics by Ostby in 1961 and later reintroduced in 1966 by Rule and Winter. Revascularization in immature teeth aims to create an aseptic environment so that ingrowth of new tissue takes place in the canal space leading to completion of root formation and maturation of tooth (Fouad 2011).



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successful clinical outcomes after regenerative endodontic procedures are seen in young patient, necrotic pulp and immature apex, minimal or no instrumentation of the dentinal walls, placement of an intracanal medicament, creation of a blood clot or protein scaffold in canal, effective coronal seal.<sup>8-18</sup>

In the first phase, disinfection of the canal space was obtained with 5.25% NaOCl and triple antibiotic paste (Iwaya et al. 2001, Banchs & Trope 2004, Ding et al. 2009, Petrino et al. 2010). Triple antibiotic paste consists of mixture of Ciprofloxacin (Cifran 500mg), Metronidazole (Metrogyl 400mg), and Minocycline paste (Minoz 50 mg) and is found to be effective for disinfection of infected necrotic pulps (Windley et al. 2005). The disadvantages being bacterial resistance and crown discolouration (Kim et al. 2010). Therefore care was taken to ensure that triple antibiotic paste remained below the CEJ and sealing the dentinal tubules with dentine bonding agent to prevent or reduce the intensity of the discoloration (Reynolds et al. 2009).

Following disinfection, appropriate scaffolding is necessary to give correct spatial location to stem cells and to regulate its differentiation, proliferation, and metabolism by different growth factors (Hargreaves et al.).<sup>19-21</sup> Platelet-rich fibrin, a second-generation platelet concentrate, is an autologous healing biomaterial incorporating leucocytes, platelets and wide range of key healing proteins in a dense fibrin matrix (Del Corso et al. 2010). Highly resistant and elastic membrane of fibrin is obtained (Lucarelli et al. 2010), which allows a slow continuous release of cytokines such as platelet-derived growth factor (PDGF), transforming growth factor b1



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(TGFb1) and vascular endothelial growth factor (VEGF) achieving peak level at 14th day coinciding with cell growth.

PRF enhances the proliferation of various cell types, stimulates cellular differentiation and supplements the angiogenesis. The presence of leucocytes and cytokines along with small amounts of lymphocytes in PRF can play a significant role in the self-regulation of inflammatory and infectious phenomenon (Toffler et al. 2009).

The radiographic changes showing continued root development, thickening of canal walls and apical closure with PRF acted as a bio scaffold by delivering growth factors into the disinfected root canal space.<sup>22-25</sup> The mesenchymal stem cells of apical papilla, osteoblasts, fibroblasts, endothelial cells and epithelial cells express cell membrane receptors to the growth factors found in platelets (Huang et al. 2008), which might have led to their proliferation from the periapical region and matrix production into the canal space.

### Conclusion :

If we can achieve natural increase in length, width of the tooth and apical closure, regenerative endodontic therapy is considered to be successful.

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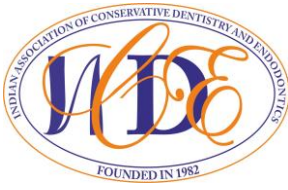
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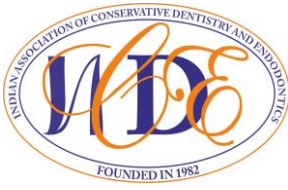
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