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RESEARCH ARTICLE

PLATELET RICH FIBRIN- A BOON TO APEXOGENESIS

***[1]Sapana A. Rathod, [2]Anil T. Patil, [3]Sandhyarani B., [4]Sukanya Bahirat and [5]Devendrapratap M. Singh**

[1]MDS 3rd Year Post Graduate Student In The Department of Pedodontics And Preventive Dentistry, Bharati Vidyapeeth Dental College and Hospital, Sangli, Maharashtra, India
[2]Professor And Head Of The Department of Pedodontics And Preventive Dentistry, Bharati Vidyapeeth Dental College and Hospital, Sangli, Maharashtra, India
[3]Associate Professor, Department of Pedodontics and Preventive Dentistry, Bharati Vidyapeeth Dental College and Hospital, Sangli, Maharashtra, India
[4]MDS 2nd Year Post Graduate student Department of Pedodontics And Preventive Dentistry, Bharati Vidyapeeth Dental College and Hospital, Sangli, Maharashtra, India
[5]MDS 1st Year Post Graduate student, Department of Pedodontics And Preventive Dentistry, Bharati Vidyapeeth Dental College and Hospital, Sangli, Maharashtra, India

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ABSTRACT

Background: Regenerative endodontic procedures are biologically based procedures which deals with the regeneration of pulp like tissue, idealistically the pulp-dentin complex. PRF has very significant slow sustained release of key growth factors like PDGF and TGF for at least 1 week and up to 28 days, which means, PRF could release growth factors with its own biological scaffold for wound healing process. This leads to the unique idea of using PRF as a capping agent for reparative dentin formation or as a biomaterial for apexogenesis. **Method:** A 9 year old boy reported to our department with a chief complaint of broken upper front tooth. Radiograph revealed an open apex with 21. The treatment plan included apexogenesis using Platelet rich fibrin (PRF) followed by MTA and composite restoration after 24 hours. **Result:** In the follow up of 3, 6 months,9 months and1 year the radiographs revealed gradual closure of apex. **Conclusion:** PRF can be a compatible material for apexogenesis and root maturation.

Corresponding author:

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INTRODUCTION

Traumatic injuries to the teeth may result in pulpal and periapical disease (Forghani, 2013). One of the primary functions of dental pulp is the formation of dentin, as a part of tooth formation apical opening gradually decreases in width during the period 3-4 years after tooth eruption. When the pulp undergoes pathological changes before complete root development, dentin formation and root growth cease leading to open apex and immature root. Therapeutic apexogenesis or vital pulp therapy (VPT) is the treatment of choice to help continue physiologic process of root growing and apex closure (Abu-Tahun, 2012) apexogenesis can be achieved by indirect pulp capping, direct pulp capping or by pulpotomy. many materials have been used for pulpotomy since years and till date, but now from the use of conventional materials like Calcium hydroxide, formocresol (FC), mineral trioxide aggregate (MTA), etc. (Abu-Tahun, 2012) Scenario has changed to the use of Platelet rich fibrin (PRF) for pulpotomy procedure. Regenerative endodontic procedures are biologically based procedures which deals with the regeneration of pulp like tissue, more idealistically the pulp-dentin complex, damaged coronal dentin such as that following a carious exposure or trauma; and regenerate resorbed root, cervical or apical dentin. The conventional method of revitalization procedure was done by inducing bleeding into the pulp canal by mechanically irritating the periapical tissues. In necrotic teeth with open apices, some amount of pulp tissue along with Hertwigs Epithelial Root Sheath may survive apically and these tissues can proliferate once the inflammatory condition are reversed and the canal becomes totally disinfected (Banchs, 2004). The created blood clot acts as a matrix for the in growth of new tissues into the pulp canal.

However, this procedure will cause discomfort for the patient while mechanically irritating the periapicalt issues. In the past two decades, an increased understanding of the physiological roles of platelets in wound healing and after tissue injury has led to the idea of using platelets as therapeutic tools. Platelet-Rich Plasma (PRP) consists of a limited volume of plasma enriched with platelets, which is obtained from the patient. The use of PRP as a potentially ideal scaffold for regenerative endodontic therapy has been documented in the literature (Torabinejad, 2011).

CASE REPORT

A 9-year-old boy came with chief complaint of broken upper front tooth along with sharp edges of the tooth hurting the lip(Figure 1). Past dental history revealed trauma to his upper front tooth one day ago. Medical history of the patient was noncontributory. Intraoral examination of his teeth revealed the presence of Ellis class III fracture with 21. Intraoral Periapical Radiographic examination of tooth revealed an immature root and an open apex of about 2-3mm approximately and thin dentinal walls (Figure 1). So a clinical decision of Pulpotomy and revascularisation using Platelet rich fibrin (PRF) in 21, to enhance apexogenesis Was taken. A written informed consent was obtained from the patient's parents. Local anesthesia was achieved using Lignocaine (1:80000 adrenaline, LIGNOX® 2%A). After the rubber dam application, access cavity preparation was done on the tooth. The coronal pulp was removed and the pulp chamber was irrigated with saline and dried, A mixture of triple antibiotic paste ,Ciprofloxacin (Cifran 500mg, Ranbaxy Lab, India), Metronidazole (Metrogyl 400mg, J.B.Chemicals and Pharmaceuticals, India), and cephalosporin paste (cefaclor 250mg, Navana pharmaceuticals Ltd.)) was prepared into a creamy consistency and introduced into the pulp chamber. A cotton pellet was placed and the cavity was temporarily sealed with cavit (Dental Products of India, India). radicular pulp was not involved in any of the steps of the procedure. The patient returned after 21 days to the clinic and was asymptomatic. Local anesthesia was given, followed by rubber dam isolation; then the access cavity was reopened and thoroughly irrigated with sterile saline solution and dried. A 10 ml sample of whole blood was drawn intravenously from the patient's left antecubital vein and centrifuged under 3000 rpm for 10 minutes to obtain the PRF which was jelly like in consistency. The PRF was condensed into the pulp chambertill cementoenamel junction (Figure 2). Grey MTA (ProRoot MTA; Dentsply) was placed directly over the PRF to a thickness of 3mm followed by a wet cotton pellet and cavit. The patient was recalled after 24 hours and the setting of MTA was confirmed. The access cavity was then double sealed with GIC and Composite restoration (Figure 4). The patient returned to the clinic after 3 months, 6 months (Figure 3) 9 months and 1 year (Figure 4) for review and was asymptomatic; the tooth showed negative response to percussion and responded positive to electric pulp tester (EPT). Radiograph revealed continued thickening of the dentinal walls, root lengthening, and apical closure (figure 4). The patient is still under review.

DISCUSSION

Apexogenesis is physiologic process leading to root end development.In this case we have aimed of apexogenesis through pulpotomy procedure for 21.

As we have seen there are many materials used for this procedure, and they have their own disadvantages. [2]Hence there is a paradigm shift from using the conventional materials to the use of PRF for pulpotomy.

Regenerative endodontics: Regenerative endodontic procedures can be defined as biologically based procedures designed to create and delivert issue store place diseased, missing and traumatized pulp-dentin complex. The science of regenerative endodontics has a long history dating back to 1952 when Dr. BW Hermann reported on the application of calcium hydroxide in a case report of vital pulp amputation. Presently, two concepts exist in regenerative endodontics to treat non-vital infected teeth - one is the active pursuit of pulp-dentine regeneration to implant or regrow pulp (tissue engineering technology), and the other in which new living tissueis expected to form from thetissuepresent in the teeth itself, allowing continued root development (revascularization) (RashmiBansal, 2011).

Triple antibiotic paste: For pulp regeneration, both the pulp space and dentinal walls need to be disinfected sufficiently for ingrowth of vital tissue. Due to the polymicrobial nature of infected root canal, single empirical antibiotic is insufficient in disinfection of the root canal. Non specific antibiotic suppress most of the microbial flora and allow residual virulent micro-organisms to repopulate the root canal. Therefore it is essential to use combination of antibiotics to act against all endodontic pathogens and to prevent resistance. Recently tripleantibiotic paste containing ciprofloxacin, metronidazole and cefaclor has been introduced for lesion sterilization and repair. Metronidazole is a nitroimidazole compound that exhibits broad spectrum of activity against protozoa and anaerobic bacteria. Its nitro group is reduced by certain redox proteins to highly reactive nitro radical after entering the cell. It binds to the DNA, disrupts the helical structure and lead to rapid cell death. Ciprofloxacin is a synthetic floroquinolone with rapid bactericidal action. It inhibits the enzyme bacterial DNA gyrase, which nicks the double stranded DNA, introduces negative supercoil and then reseals the nicked end. The bactericidal action probably results from digestion of DNA by exonucleases whose production is signaled by the damaged DNA. It exhibits very potent activity against gram negative bacteria but very limited activity against gram positive bacteria. Most of the anaerobic bacteria are resistant to ciprofloxacin. Hence it is often combined with metronidazole in treating mixed infections. [7]Cefaclor is a semisynthetic cephalosporinthe bactericidal action of Cefaclor results from inhibition of cell-wall synthesis.

PRF: PRF was developed in France by Choukroun *et al*, in 2001.PRF consists of an autologous leukocyte-platelet-rich fibrin matrix composed of a molecular structure, with cytokines, platelets, and stem cells within it.which acts as a biodegradable scaffold that favors the development of microvascularization. [6]Top-most layer consisting of a cellular plasma. PRF clot in the middle.Red corpuscle base at the bottom (David M.Dohan, 2006).

Angiogenesis: For optimal woundhealing ,cascade of complex, orderly events are included like hemostasis, inflammation, proliferation and remodelling. Platelets regulate hemostasis by vascular obliteration and fibrin clot formation. In the platelets α granules are the biggest storage compartmentsof lysosomes, α granules and. from the clot platelets are responsible for activation and release of important biomolecules from α

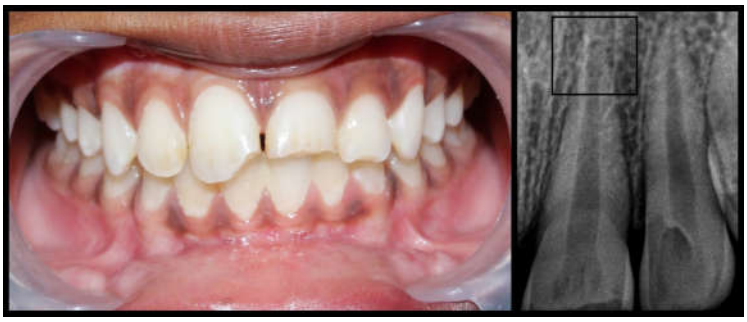

Figure 1. Broken upper front tooth 21 and preoperative rvg showing immature root and an open apex associated with thin dentinal walls

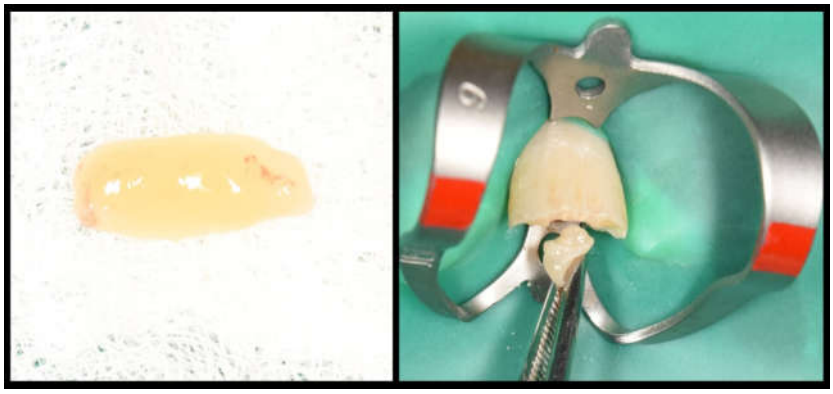

Figure 2. PRF and its placement in the pulp chamber

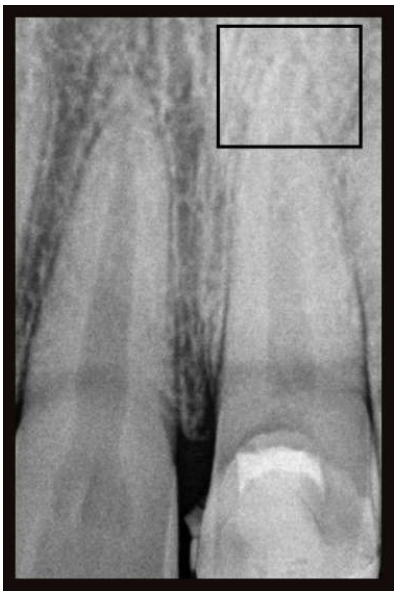

Figure 3. Rvg 6 months after procedure showing gradual closure of root apex

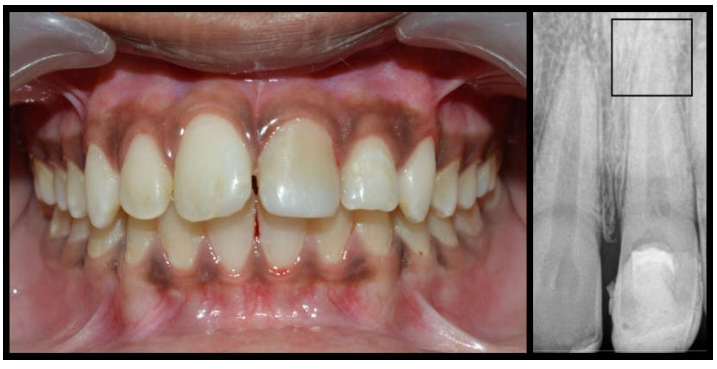

Figure 4. Double sealed with GIC and Composite restoration and rvg after 1 year there is continued thickening of the dentinal walls, root lengthening, and apical closure

granules like platelets specific proteins, growth factors, coagulation factors, cytokines/ chemokines, angiogenic factors, etc. the release of cytokines/ chemokines and growth factors induces proliferation and activation of cells in wound healing like fibroblasts and activation of cells in wound healing like fibroblasts, and activation of cells in wound healing like fibroblasts, neutrophils, monocytes, mesenchymal cells, etc after inflammatory phase wound healing requires angiogenesis which include activation, proliferation and migration of endothelial cells to form new blood vessels (Constanza, 2015). Mechanics behind the revitalization endodontic procedure is that, despite tooth being necrotic, some pulp tissue can survive apically which under favorable conditions proliferate to aid in the process of regeneration (Trope, 2010; Ritter, 2014)

Conclusion

In vitro and in vivo studies have demonstrated safe and promising results, without contradictory findings, related to the use of PRF alone or in combination with other biomaterials. Currently, platelet-rich fibrin seems to be an accepted minimally invasive technique with low risks and satisfactory clinical results and from the results obtained in the present case we conclude, PRF can be a compatible material for apexogenesis and root maturation.

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