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EVALUATION OF CLINICAL AND RADIOGRAPHICAL OUTCOME OF WITH PLATELET RICH FIBRIN IN THE REVITALIZATION OF TOOTH WITH NECROTIC PULP AND OPEN APEX UTILIZING CBCT – A CASE SERIES

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Conflicts of Interest: Nil

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Abstract:
Aim: To examine the clinical and radiographic appearance of teeth that suffered premature interruption of root development and were treated by platelet rich fibrin as a matrix.
Summary: Four teeth with immature root apices in 4 patients were treated nonsurgically by the manual application of Triple antibiotic paste was placed inside the canal and left for 21 days. 12 ml of whole blood was drawn from the patient's right antecubital vein and centrifuged for 10 minutes to obtain the Choukroun's PRF. After the removal of the triple antibiotic paste, the PRF was placed into the canal till the level of cementoenamel junction and 3mm of MTA was placed directly over the PRF clot. After 1 year the clinical examination revealed negative responses to percussion and palpation tests. The tooth responded positively to cold and electric pulp tests. Radiographic examination revealed continued thickening of the dentinal walls, root lengthening, regression of the periapical lesion and apical closure.
Four teeth with immature root apices in 4 patients were treated nonsurgically by the manual application of in the apical portion of the root canal under microscopic vision. Follow-up evaluations were performed at 3months, 9 and 12 months after treatment.
Keywords: Mineral trioxide aggregate, necrotic pulp, Revascularization, open apices. Platelet rich fibrin

1. Introduction

Traditionally apexification has been opted for the treatment of immature permanent teeth with necrotic pulp. Revascularization of an immature tooth with apical periodontitis, a paradigm shift occurred in 2001 by Iwaya et al.[1] most of the studies include resolution of periapical lesions, continued root development and even the recovery of tooth vitality.

Regenerative endodontic procedures are defined as biologically based procedures designed to replace damaged structures, including dentin and root structures, as well as cells of the pulp-dentin complex.[2] The theory behind the revasularization is that despite the tooth being necrotic, some pulp tissue can undergo proliferation under favourable conditions to initiate the process of regeneration.[3] Earlier regeneration was done by inducing bleeding in the pulp canal by mechanically irritating the periapical tissues. The blood clot created asct as a matrix for the growth of new tissues.[4]

In the past two decades, the idea of using platelets in wound healing and tissue injury has come into existence. Since Platelet-Rich Plasma (PRP) consists of less amount of platelets, which is obtained from the patient. The use of platelet rich fibrin has been used as an ideal scaffold for regeneration of the tooth.[5]

Development of the second generation Platelet concentrate known as Choukroun's Platelet Rich

Fibrin (PRF) which is totally autologous in nature. PRF was developed in France by Choukroun *et al*, in 2001.[6] This technique is very simple and inexpensive. PRF contains platelets, growth factors, and cytokines that might enhance the healing potential of both soft and hard tissues.[7] The purpose of this case series is to add a regenerative endodontic case to the existing literature about using PRF.

2. CASE REPORTS

A female patient of 18 year old came to the department with a chief complaint of pain in the upper right cental incisor. Clinically, we found that there was complicated crown fracture (Ellis class III) in relation to upper right central incisor (11). The tooth was carious and fractured which showed positive response to tender on percussion and palpation. There was no response to the pulp vitality tests using, cold test and electric pulp testing (Figure 1a,1b,1c,1d,1e).

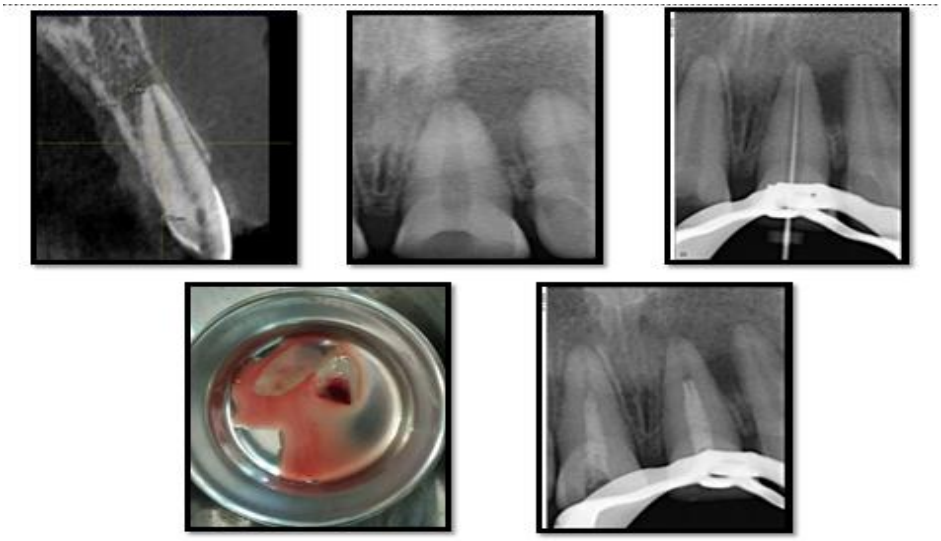

Figure 1(a,b,c,d,e): Showing pre-op CBCT, pre-op radiograph, working length, PRF, Insertion of PRF respectively.

CASE REPORT 2

A male patient of 19 years old came to the department with a chief complaint of pain in the upper left cental incisor. The incisor was slightly tender to percussion. No mobility was seen. On electric pulp testing, the upper right central incisor (11) was non-responsive.

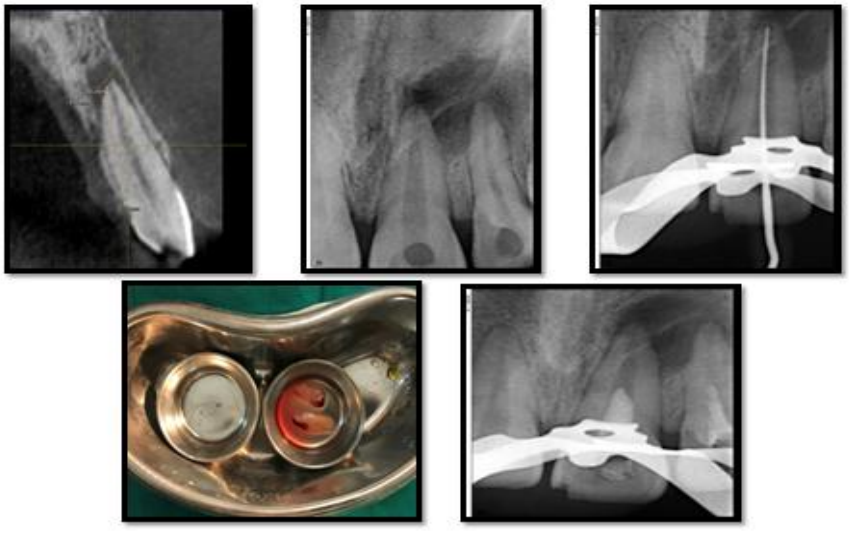

Figure 2(a,b,c,d): Showing pre-op CBCT, pre-op radiograph, working length, PRF, Insertion of PRF respectively.

CASE REPORT 3

A male patient of 21 years old came to the department with a chief complaint of pain in the upper left cental incisor.Clinical examination revealed grayish discoloration of tooth 21 and attempted access preparation in the same tooth. The tooth did not demonstrate any abnormal mobility or sensitivity to percussion. Both cold and electric sensibility tests failed to elicit any response. Periapical radiograph showed well-defined periapical radiolucency and wide open apex in relation to tooth 21. The final diagnosis was pulpal necrosis with chronic apical periodontitis in relation to tooth 21.

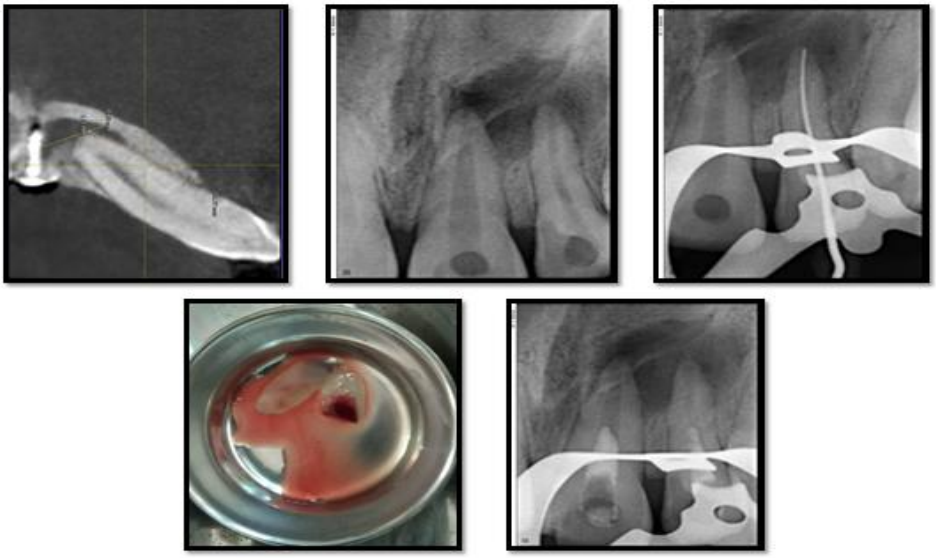

Figure 3(a,b,c,d,e): Showing pre-op CBCT, pre-op radiograph, working length, PRF, Insertion of PRF respectively.

CASE REPORT 4

A female patient of 20 years old came to the department with a chief complaint of pain in the upper left cental incisor. The incisor was slightly tender to percussion. No mobility was seen. On electric pulp testing, the upper right central incisor (11) was non-responsive.

Figure 4 (a,b,c,d,e): Showing pre-op CBCT, pre-op radiograph, working length, PRF, Insertion of PRF respectively..

PROCEDURE

A peri-apical radiograph was taken which showed an open apex associated with peri-apical lesion. A preoperative CBCT Scan was taken to evaluate the extent of lesion, diameter of apical foramen and root length. Non-surgical treatment Revascularization was opted for the patient. Patient was administered local anesthesia, access cavity was then prepared under rubber dam isolation. Working length is the determined with a no. 15 k file and confirmed with RVG Root canal was then prepared upto no. 80 k file. The canal was the irrigated with 1% NaOCl and saline. The canal was then dried with paper points and triple antibiotic paste (metronidazole, minocycline, and ciprofloxacine) was placed in the canal as an intra canal medicament. After that the access cavity was sealed with a temporary restoration.

After 3 weeks the patient was recalled, the tooth was asymptomatic and non tender on percussion. The canal was then irrigated and dried with paper points. Then we decided to place PRF as a matrix over which MTA is placed as till Cemento-Enamel junction. Platelet rich fibrin membrane was prepared using the procedure described by Dohan et al. blood (8.5 ml) was drawn by venipuncture of the anticubital vein. This blood was collected in a 10 ml sterile glass tube without anticoagulant, and was centrifuged immediately at 3000 revolutions/min (rpm) for 10 min. After the centrifugation the resultant in the glass tube consisted of the topmost layer of acellular platelet poor plasma, PRF clot in the middle and red blood cell's at the bottom. The PRF clot was squeezed to obtain a PRF membrane.

Figure 5: Showing acellular platelet poor plasma, PRF clot in the middle and red blood cell's at the bottom.

The PRF membrane was cut into two halves to reduce the size of the membrane PRF membrane was introduced into the canal and was gently compacted using hand pluggers to form an apical barrier. MTA was mixed according to the manufacturer's instructions and was placed in canal over the PRF matrix, till the level of CEJ. A wet cotton pellet was placed into the canal, access cavity was sealed with temporary cement. After 1 week the patient was asymptomatic, the tooth was isolated with rubber dam, temporary restoration and cotton pellet was removed. A hand plugger was tapped against the MTA barrier to confirm the setting of MTA. The access cavity was restored with resin composite. The patient was recalled at 3 months, 9 months and 1 year postoperatively for 4 cases (figure 6,7,8). At 3 months recall, radiograph was taken, which showed a decreased in the size of the lesion, closure of the apical diameter and increase in the root length including vitality. Post Operative CBCT at 1 year showed complete healing of the lesion, closure of apical diameter and increase in the root length. At 9^{th} and 12^{th} month all the four cases of revascularization showed positive response to cold test and electric pulp test.

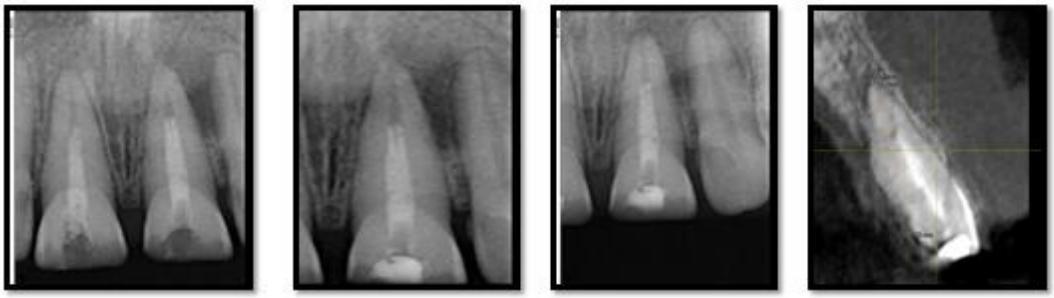

Figure 6 (a,b,c,d): Showing 3^{rd} month, 9^{th} month, 12^{th} month, post-op CBCT respectively for case 1.

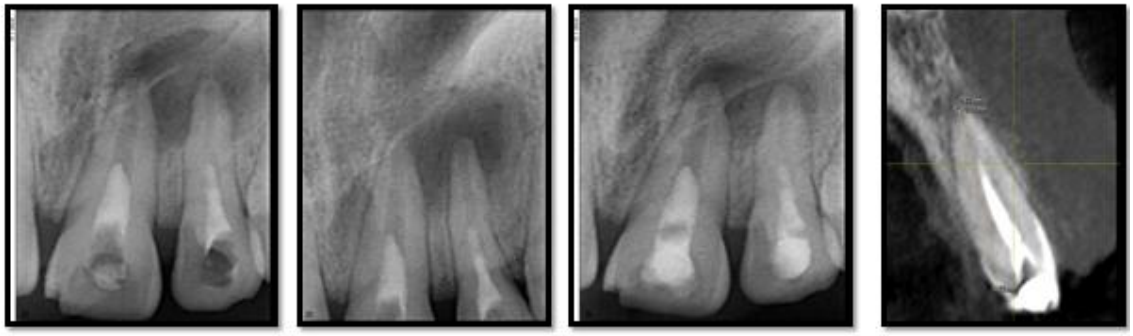

Figure 7 (a,b,c,d): Showing 3rd month, 9th month, 12th month, post-op CBCT respectively for case 2.

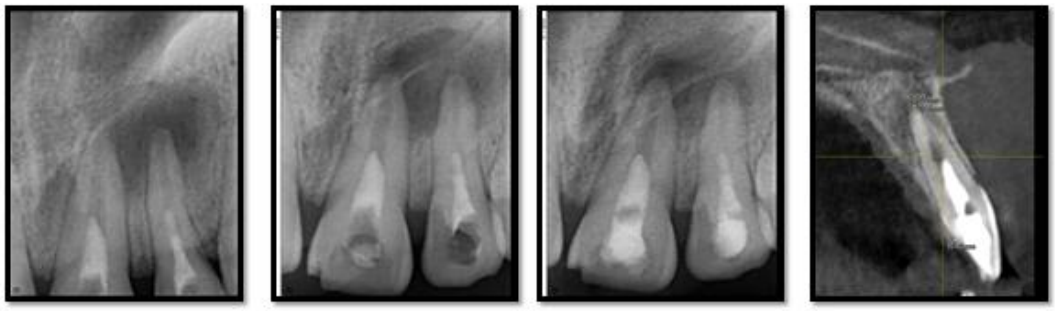

Figure 8 (a,b,c,d): Showing 3rd month, 9th month, 12th month, post-op CBCT respectively for case 3.

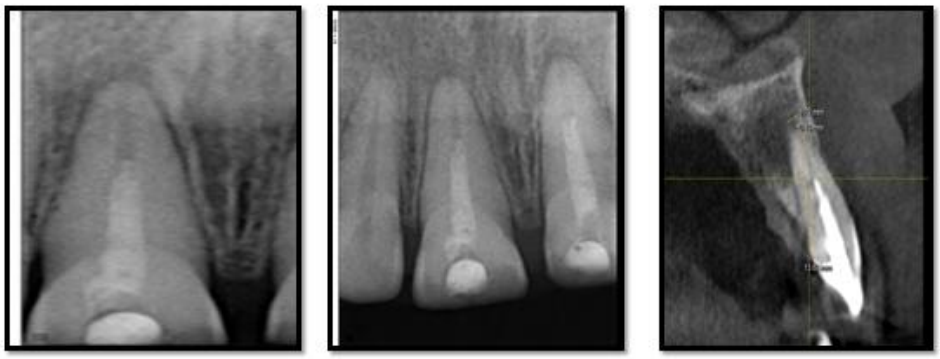

Figure 9 (a,b,c,d): Showing 3rd month, 9th month, 12th month, post-op CBCT respectively for case 4.

3. DISCUSSION

A quest is always seen for a material that can regenerate odontogenic tissue successfully both from a periodontal and endodontic aspect. Regeneration is the ideal desirable outcome for any restorative procedures. The main objective of this treatment is usually achieved in the form of continuing root development, dentinal wall thickness, and apical closure along with resolution of periapical periodontitis.[8]

The rationale of revascularization is that if a sterile tissue matrix is provided in which new cells can grow, pulp vitality can be re-established. The Protocols for Revascularization are derived from the observations of re-implanted and auto-transplanted teeth in which necrotic pulp, devoid of infection, provide a matrix into which the cells from the peri-radicular region could grow and re-establish pulp vascularity. The sterile matrix that is created is the key to success of treatment.[9]

PRF is an immune platelet concentrate which has been used as a matrix. In the present case, Choukroun's technique for making PRF was used. The advantages of Choukroun's technique and PRF in general are[10,11]

- It contains growth factors including transforming growth factor beta, vascular endothelial growth factor, and platelet-derived growth factor Platelet rich fibrin stimulates osteoblasts, gingival fibroblasts and periodontal ligament cells proliferation as a mitogen
- Platelet rich fibrin is an immune platelet concentrate, collecting all the constituents of a blood sample favorable to healing and immunity on a single fibrin membrane
- Does not dissolve quickly after application
- Completely natural, no use of chemicals
- Low cost and greater ease of the procedure
- Ability to produce PRF in large quantities
- Completely autologous and biocompatible.

Platelet rich fibrin membrane has a soft consistency and it inherently contains some amount of moisture, still it serves as a good matrix material for placement of MTA, this is because MTA has a wet sand like consistency and can be placed without pressure application and therefore it does not require a pressure-resistant matrix for application.[12] Moreover, MTA sets in the presence of moisture and does not require a moisture-free environment.[13] Another advantage of using PRF as a matrix is that it promotes wound healing and repair.[14] In teeth with open apices and thin root canal walls instrumentation cannot be done properly, thus cleaning and disinfection of the root canal system rely on the chemical action of irrigant and intracanal medicament[15]. In the present case canal disinfection was achieved by irrigation with 1% NaOCl and saline. NaOCl is known to be toxic, especially in higher concentrations.[16] There is an increased risk of pushing the irrigant beyond the apex in immature teeth with open apices, therefore a lower concentration of 1% NaOCl was used in the present case.[17] Further disinfection was achieved by the use of triple antibiotic paste as an intracanal medicaments. The most commonly used medicament is a combination of three antibiotics, referred to as triple antibiotic, paste (TAP).[18] This formulation was first used by Sato et.al (1996) and contains metronidazole, ciprofloxacin and minocycline. This combination is commercially available as 3-MIX MP.[19]

4. CONCLUSION

On the basis of the results obtained in our case series, we conclude that revitalization of necrotic infected immature tooth is possible under conditions of total canal disinfection and PRF is an ideal biomaterial for pulp-dentin complex regeneration. On radiographic examination, we could elucidate that there was continued thickening of the dentinal walls, root lengthening, regression of the periapical lesion and apical closure in 1 year which can be due to the use of PRF. Based on the clinical and radiographic examination we can only say with certainty that the pulp space had returned to a vital state.

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