CASE REPORT

APPLICATION OF PLATELET RICH FIBRIN AS A DIRECT PULP CAPPING AGENT - A REPORT OF THREE CASES

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ABSTRACT

Traditionally, Direct Pulp Capping (DPC) procedure using Calcium hydroxide is advocated for management of pinpoint pulp exposure due to iatrogenic and traumatic causes. But in cases of carious exposure, pulpectomy/ Root canal therapy is the convention as DPC with calcium hydroxide in such situation is unpredictable and outcome is uncertain. Bioactive materials such as MTA and Biodentineare being used successfully recently due to their effect on undifferentiated mesenchymal stem cells of pulp. But there are some drawbacks with these materials. Platelet rich fibrin (PRF), a platelet concentrate has become popular in the field of endodontics. It is rich in growth factors and cytokines. It utilizes the undifferentiated cells and differentiate them to odontoblasts, allows them to proliferate for the formation of dentinal bridge effectively at the site of exposure. But clinical report using PRF in DPC is sparse. Keeping this in view, DPC was performed on cariously exposed pulps with autologous PRF in three cases.

Detailed procedure and result of DPC upto 12 months follow up in one tooth and 6 month in another two have been reported here. IOPAR revealed definite calcific bridge formation across the breach in all the cases.

KEY WORDS

Direct Pulp Capping, PRF, Calcific bridge

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INTRODUCTION

Reparative dentin is synthesized by the replacement odontoblasts which are formed by the differentiation of the undifferentiated mesenchymal cells of the pulp. Reparative dentin deposition becomes apparent microscopically about one month from the inception of the inflammatory stimulus which is structurally and chemically different from primary and secondary dentin, being highly atubular, impervious to most of the irritants. The deposition of reparative dentin acts as a shielding barrier for the pulp-dentin complex. It is a continuous but relatively slow process. It takes around 100 days to form a reparative dentin layer of 0.12 mm thickness. [1]

Direct Pulp Capping (DPC) is defined as a procedure in which the exposed vital pulp is covered with a protective dressing or base placed directly over the site of exposure in an attempt to preserve pulpal vitality. Traditional materials such as Calcium hydroxide used for this purpose did not sustain a favorable environment for longer periods. Calcium hydroxide has excellent antibacterial property due to its ability to maintain high alkaline pH. But has very obvious disadvantages like pulp surface necrosis, tunnel defects in dentin bridge, leading to possible microleakage; high solubility in oral fluids, poor adhesion and degradation over time leading to void formation.[2-5] This created an uncertainty regarding the success of DPC.

Although MTA and Biodentine have shown brighter results in maintaining pulp vitality by inducing the differentiation of undifferentiated mesenchymal stem cells to form odontoblast like cells and produce reparative dentin bridge, they have exhibited certain inherent disadvantages. During initial setting, some of the formulations of MTA release toxic products,[6] and also show longer setting time, difficult handling properties and tooth discolouration.[7-9] While, Biodentine has demonstrated poor radiopacity and low washout resistance.[9,10]

Platelet Rich Fibrin (PRF) has become a vital part of contemporary endodontics. It has shown promising effects concerning healing in pulpotomy, partial pulpotomy, and regenerative endodontic

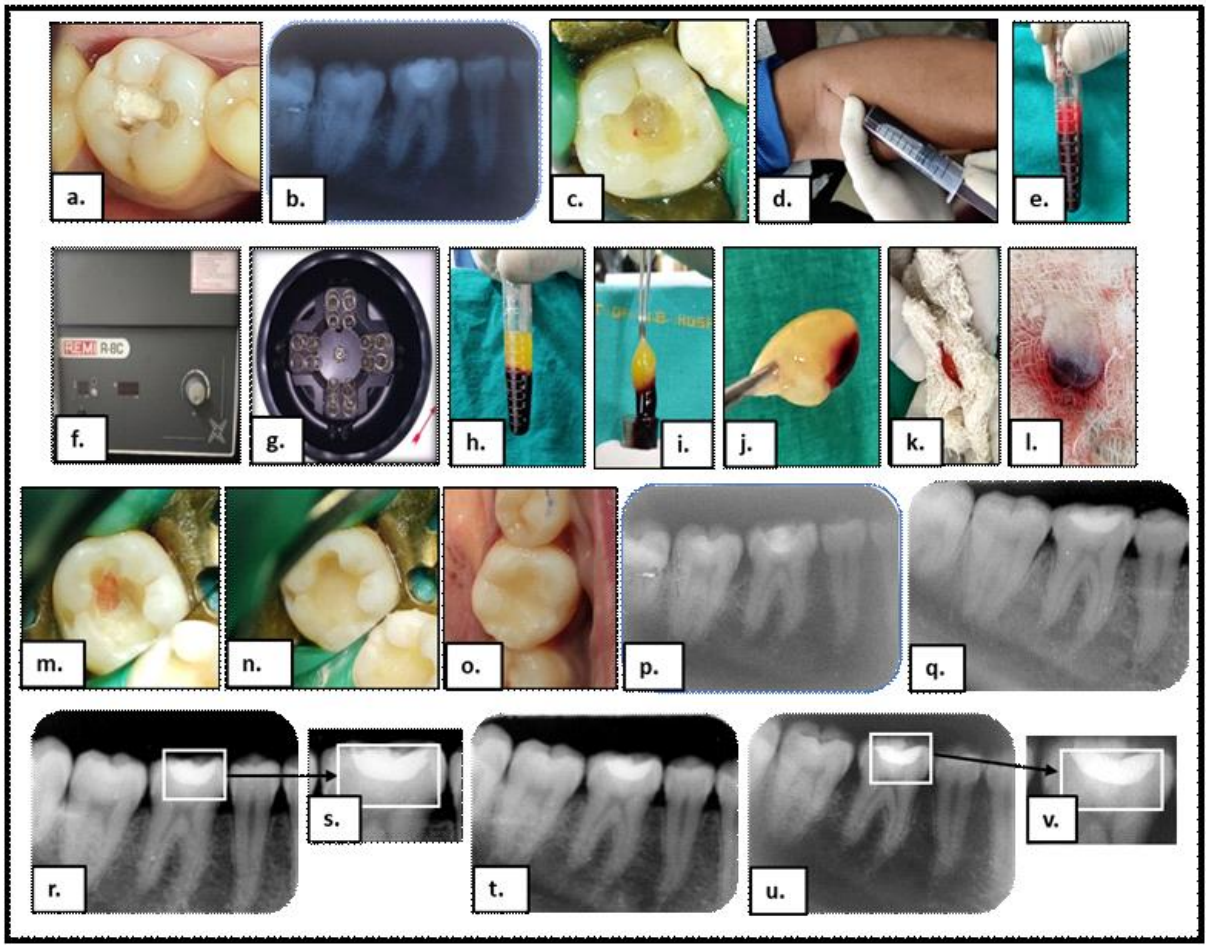
procedures. It was first advocated by Choukroun et al.[12] and is called a second-generation platelet concentrate. Its strong flexible natural fibrin matrix enmeshes almost all the platelets and growth factors of the blood harvest.[12,13] Its utility as a DPC agent is a subject of recent research, as the growth factors and cytokines existing in the platelet concentrate are identified to play a key role in mesenchymal cell differentiation and hard tissue deposition, by demonstrating chemotactic and mitogenic properties which promote and modulate cellular functions.[6] Though a large number of studies conducted with various agents for DPC have been reported in the past with variable success rates, literature regarding PRF as a DPC agent is very sparse. Therefore, the present study was designed to investigate the healing effects of PRF following DPC treatment on three teeth with cariously exposed pulp.

MATERIALS AND METHODS

The patients were selected from the OPD of the Department of Conservative Dentistry and Endodontics, Dr. R Ahmed Dental College and Hospital. After obtaining informed consent from the patients, clearance from the institutional ethics committee was taken. In all the three cases autologous PRF was used and the patients were advised to report at 1st, 3rd, 6th month postoperatively, then after every 6 months interval or whenever any symptom arises.

CASE NO 1

A 22-year-old female patient reported with a chief complaint of broken filling in the lower right back tooth with sensitivity and mild pain on food lodgement. On clinical examination, dislodged temporary restoration with exposure of carious dentin was found on 46 (Fig 1a), with no tenderness on percussion. Intra-oral Periapical Radiograph (IOPAR) revealed carious dentin below the remaining restorative material almost involving the pulp. (Fig 1b) Pulp sensibility tests were carried out using a cold spray (Roeko Endofrost, Coltene Whaledent, Switzerland) and a digital Electric Pulp Tester (EPT), both of which elicited positive response. A diagnosis of reversible pulpitis was done, and a tentative decision was taken to cap the pulp if, according to the previous researcher[14] the size of exposure after caries removal remained within 2.5 mm and controllable hemorrhage within 10 minutes[15], otherwise, root canal therapy was planned to be performed. The tooth was anesthetized (2 % lignocaine with adrenaline 1:100000) and rubber dam isolation was achieved. The broken temporary



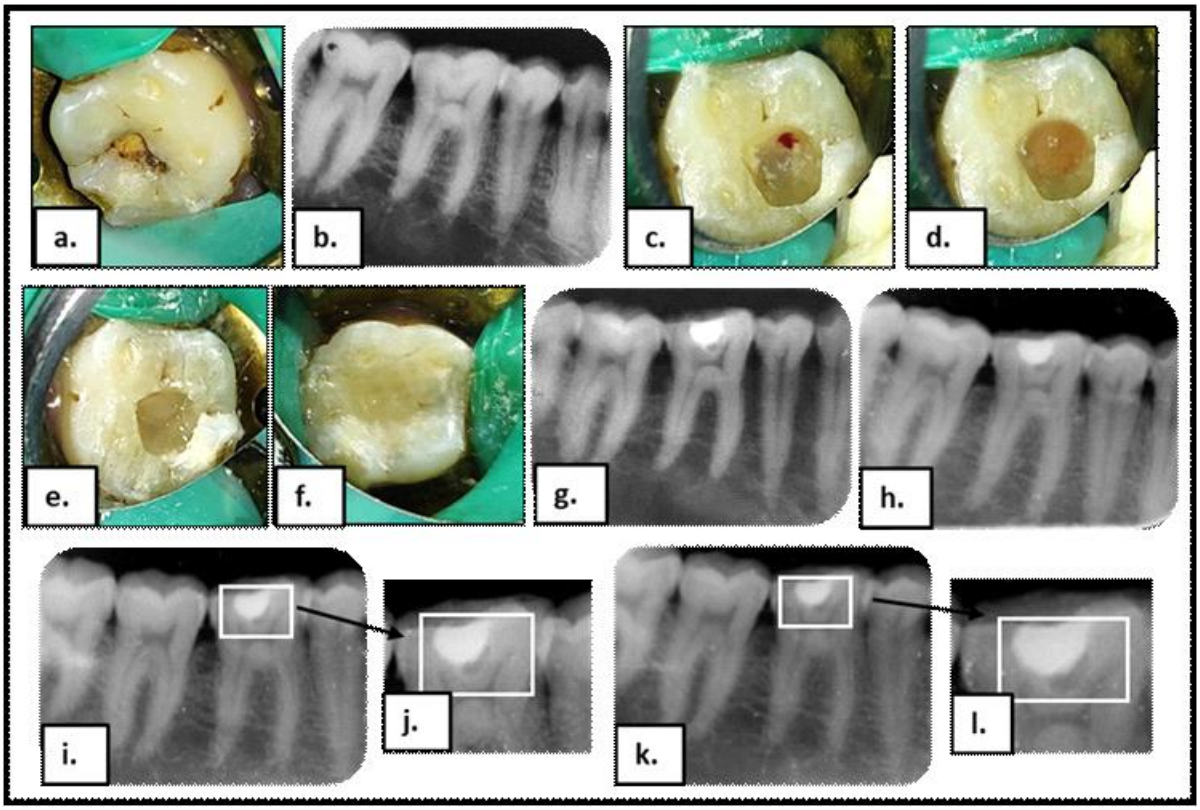


Fig 2: Case No. 2 (Tooth No.46) a. Pre-operative clinical view b. Pre-operative IOPAR c.Pulp exposure of around 2 mm after caries removal d.Piece of PRF membrane placed over the exposed pulpe. Placement of RMGIC liner f. Restoration with Composite Resin g. Immediate post-operative IOPAR h. 1 month follow-up i. 3 months follow-up j. magnified view showing formed dentin bridge k. 6 months follow-up l. magnified view showing formed dentin bridge

restoration was removed and caries excavation was carried out initially with a sterile high speed round diamond bur, followed by a sterile low-speed carbide round bur no.4, on nearing the pulp. A pulpal exposure within 1.5 mm was encountered. (Fig 1c) The floor of the cavity was irrigated with normal saline and the bleeding was stopped after giving gentle pressure with a pledget of cotton soaked in 3% sodium hypochlorite (Prime Dental, India) solution within 4-5 minutes. Once the hemorrhage was controlled, DPC procedure was carried out with PRF membrane.

The PRF was prepared as per the protocol developed by Choukroun et al.1210 ml of blood from the patient's antecubital vein was withdrawn(Fig 1d). It was then immediately transferred into a sterile test tube without adding any anticoagulant (Fig 1e) and was subjected to centrifugation at 2700 rpm for 12 minutes in a centrifugation machine [Remi R-8C centrifuge, India] (Fig 1-f, g). The resultant product segregated into 3 distinct layers with Platelet poor plasma (PPP) occupying the top portion of the test tube, RBC at the bottom, and PRF between these two layers(Fig 1h) which was taken out from the test tube using a sterile tweezer. (Fig 1-i, j) Then PRF was compressed gently with a sterile gauze(Fig 1-k, l)and was cut into pieces andplaced over the pulpal exposure(Fig 1m).Resin-modified glass ionomer cement (RMGIC) (GC Gold Label 2 LC) was then placed over the membrane and the cavity floor as a liner (Fig 1n).And final restoration was done with composite resin (Te-Econom Plus composite, Ivoclar Vivadent, Liechtenstein) (Fig10). Immediate post op IOPAR was taken (Fig 1p).Follow up could be done for12 months for this patient. The patient did no complain of any pain, swelling and sensitivity due to cold or hot substances on any of the recall visits. The tooth was not tender and was functioning normally. Cold test and EPT for pulp sensibility were found positive. IOPAR was taken in each visit (Fig 1-q-v). Dentin bridge formation can be noted from 3 months visit.

CASE NO 2

A 25-year-old male patient reported with a chief complaint of pain concerning the lower right back tooth region during chewing and taking cold water and the pain also persisted for a short duration. Clinical evaluation showed deep occlusal caries of 46 (Fig 2a). Tooth was non tender to percussion and

palpation. IOPAR (Fig 2b)showed deep occlusal radiolucency approximating the pulp. Absence of periapical lesion was noted. Pulp sensibility tests elicited positive response. A diagnosis of reversible pulpitis of 46 was made. After anesthesia (2% lignocaine with adrenaline 1:100000) and rubber dam application, carious dentin was removed and a pulp exposure of around 2 mm was found (Fig 2c).The bleeding was controlled within few minutes with gentle pressure with cotton pellets soaked in 3% NaOCl. The cavity was gently irrigated with saline. The procedure of DPC with autologous PRF was performed similar to case no.1(Fig2-d-f). The patient upto 6 months follow up was completely asymptomatic. Follow up IOPAR showed the evidence of dentinal bridge formation (Fig -2h-l).

CASE NO 3

A 28-year-old male reported with a similar complaint as in case no.2 in the lower left back tooth. Tooth in concern was 36 with deep occlusal caries (Fig 3a). IOPAR (Fig 3b) showed deep coronal radiolucency approximating the pulp. Absence of periapical lesion was noted. The tooth responded positively to the pulp sensibility tests. Diagnosis of reversible pulpitis of 36 was made. After anesthesia (2% lignocaine with adrenaline 1:100000), rubber dam application and caries removal, exposure of around 2.5 mm was found. Bleeding was controlled similarly within few minutes and DPC procedure was undertaken in the same way as it was done in earlier two cases (Fig-3c- f).There was no complaint from the patient in follow up visits done upto 6 months period. The IOPAR in 1st(Fig 3h), 3rd (Fig-3i, j), 6th months (Fig-3k, l) were recorded. The dentinal bridge could be evident from the IOPAR at 3 month and onwards.

RESULTS

All three cases, up to the last respective follow up visit, did not present with any sign or symptom, percussion and palpation tests were negative and gave a positive response to cold test and EPT. IOPAR revealed deposition of reparative dentin at the site of exposure with intact and continuous lamina dura with no periodontal ligament space thickening indicating success of DPC.

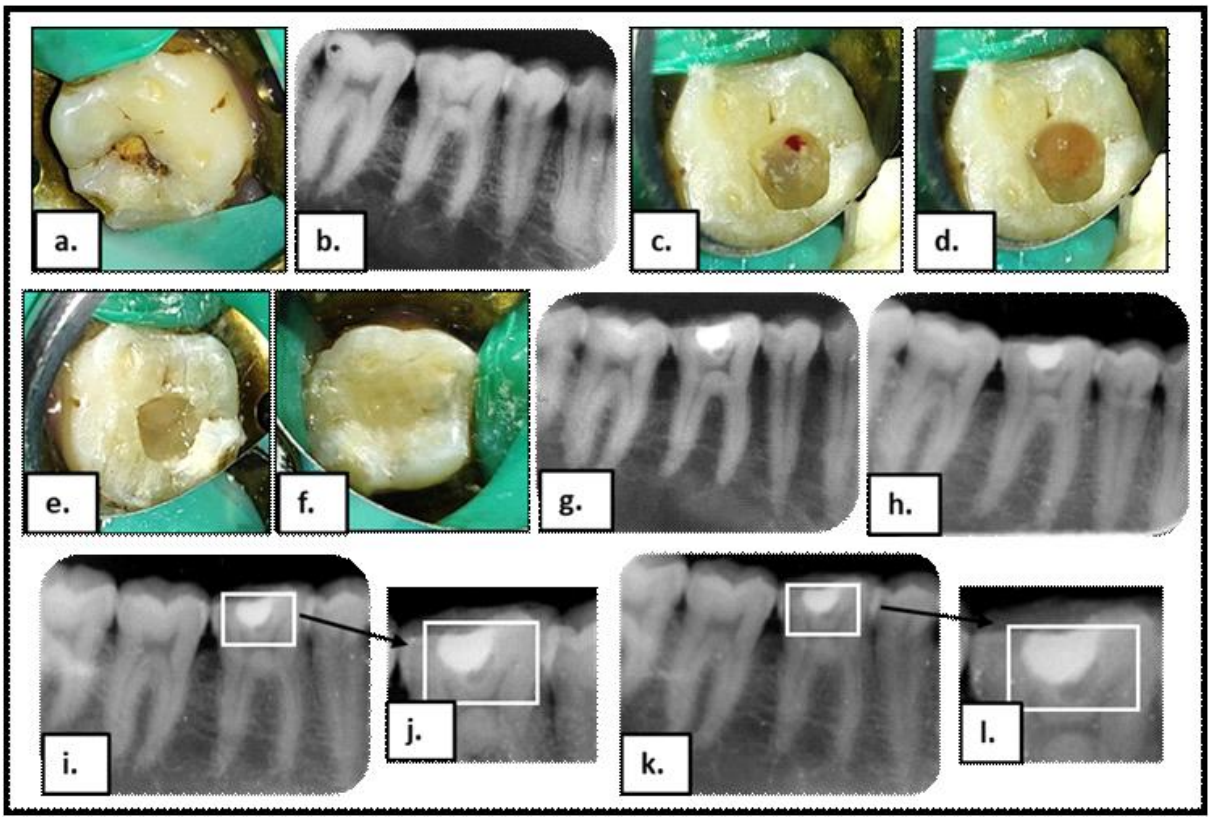


Fig 3: Case No. 3 (Tooth No.36) a. Pre-operative clinical view b. Pre-operative IOPAR c.Pulp exposure of around 2.5 mm after caries removal d.Piece of PRF membrane placed over the exposed pulpe. Placement of RMGIC liner f. Restoration with Composite Resin g. Immediate post-operative IOPAR h. 1 month follow-up i. 3 months follow-up j. magnified view showing formed dentin bridge k. 6 months follow-up l. magnified view showing formed dentin bridge.

DISCUSSION

Literature is bountiful to prove the success of newer materials like MTA and Biodentine over traditional pulp capping agents, but has their own disadvantages as stated before. There are several advantages of PRF. It can be made from the patient's own blood through single-step centrifugation process without the addition of any external agents[16] having no chance of occurring any immunogenic reaction. It forms a fine and flexible fibrin clot network supporting growth factor and cytokines enmeshment and cellular migration.[12] Sustained release of growth factors like Platelet Derived Growth Factor (PDGF), Vascular Endothelial Growth Factor (VEGF), Transforming Growth Factor β1 (TGF β1), Epidermal Growth Factor (EGF) and Insulin like Growth Factor-1 (IGF-1)[13] etc. upto 14 days, the time for cell growth and regeneration, is observed. It raises alkaline phosphatase and osteoprotegerin activity leading to the differentiation of mesenchymal cells of the pulp into odontoblast-like cells and induce the mineralization process.[17] A similar case report[6] compared the clinical efficiency of PRF & Concentrated Growth Factor with MTA and it was found that former two materials had comparable clinical efficiency to the latter in maintaining pulp vitality, but radiographic evidence of dentin bridge formation was not reported. So possibly this is the first case series with three patients which reports the ability of PRF to induce reparative dentinogenesis, displayed as dentin bridge formation on periapical radiographs, when used as a pulp capping agent without any other osteo-inductive material like MTA or Biodentine as an adjunct.

CONCLUSION

Within the constraints, limitations and follow up periods of the present study it may be stated that PRF holds potential in stimulating reparative dentinogenesis. However, more number of studies with a greater sample size and follow-ups for longer period of time are required to validate this claim and ratify its usage as a pulp capping agent apart from Biodentine and MTA, thus envisaging this concept into reality.

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