Management of pulpal floor perforation and grade II Furcation involvement using mineral trioxide aggregate and platelet rich fibrin: A clinical report

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Abstract

To report the management of an iatrogenic perforation of pulpal floor in the furcation of mandibular first molar, using Mineral Trioxide Aggregate (MTA) and platelet rich fibrin (PRF). Unpredictable endodontic root/pulp chamber floor perforations resulting in unacceptable high rate of clinical failure has now been a lesser threat with the advent of new technologies and biocompatible materials that utilize the applications of basic research along with tissue engineering concept in clinical practice. Present case report illustrates the use of MTA and platelet rich fibrin (PRF) for the repair of the perforation defect and regeneration of the lost periodontium in furcation area. Although, histologic events and reaction of MTA with PRF is not studied so far, however, the autologous and biocompatible nature of the components used for present treatment modalities seems to be beneficial for the long term clinical results obtained in our case.

Key Words: Dental operating microscope, endodontic perforation, mineral trioxide aggregate, and platelet rich fibrin

Introduction

Accidental root or pulp chamber perforation is amongst the major complications of endodontic and restorative treatments,[1] that results in loss of integrity of root and adjacent periodontium,[2,3] and is considered to be the second greatest cause of endodontic failure.[4] Besides being iatrogenic in origin, root perforations are also created pathologically by resorption and caries.[5] Resultant chronic inflammatory reaction characterized by formation of granulation tissue, may consequently lead to irreversible attachment, bone and tooth loss.[1]

Such defects have been repaired both surgically and non-surgically using different materials such as zinc oxide eugenol, Cavit, calcium hydroxide, glass ionomer cement, amalgam, gutta percha, tricalcium phosphate, hydroxyapatite,[6,7] cold ceramic,[8] Mineral Trioxide Aggregate (MTA),[1,3,8] and Portland cement.[3] Although, above listed materials are reasonably biocompatible and result in successful repair of the root perforation, however concomitant regeneration of the lost periodontium is the elusive goal of the present day dentistry. A more recent paradigm shift from classical endodontic surgery to regenerative endodontic therapy is further revolutionized by the introduction of PRF.[9,10] Present case report illustrates the use of MTA and platelet rich fibrin for the repair of the endodontic perforation defect and regeneration of the lost periodontium.

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Case Report

A 39 year old systemically healthy, non-smoker male patient reported to the department of Conservative Dentistry and Endodontics with the chief complaint of continuous dull pain in right lower back region of the jaw for more than 4 months. Past dental history revealed that the patient had undergone root canal treatment by a general dental practitioner 4 months ago, after having spontaneous pain, and was advised extraction of the tooth in question. However, patient was reluctant for the extraction, and reported to the institution for its management. Clinical examination showed root canal filled right mandibular first molar (tooth 46), with dislodged temporary restoration and periodontal probing depth of 10 mm in tooth 46 on lingual aspect, and access cavity preparation in right mandibular second molar (tooth 47). Periodontal consultation was obtained. Careful probing on the lingual aspect of the tooth 46 showed horizontal attachment loss in the furcation area, like a cul-de-sac. Tooth 46 was sensitive to percussion, and grade II mobile, but tooth 47 was symptomless. Radiographic examination revealed under-filled mesial and distal root canals along with a radiolucency in the inter radicular furcation area as well as a peri-radicular lesion associated with mesial root in tooth 46, and overzealous access cavity preparation in 47. To ascertain any canal morphological variation, eccentric radiographs at different angulations were taken. Vigilant examination of the radiograph of the tooth 46 showed excessive access cavity cutting and coronal extension of the radiolucency from furcation area, which was suggestive of pulp chamber floor perforation [Figure 1]. Close examination of the tooth 46 under operating dental microscope (Global, USA) at 10× magnification revealed sealed gutta-percha in the mesial and distal root canal orifices and a pulpal floor perforation [Figure 2].

The condition was diagnosed as retrograde periodontitis along with Grade II furcation (Glickman's) involvement with definitive pulpal perforation resulting in a primary endodontic and secondary periodontal lesion[11] in the tooth 46, as well as incomplete root canal treatment of tooth 47. Treatment plan comprised of scaling root planing, and endodontic re-treatment in 46 as well as endodontic therapy completion in the tooth 47 followed by regenerative periodontal surgery.

Endodontic retreatment was initiated under rubber-dam isolation. Gutta-percha solvent Endosolv E (Septodont, France), and H-files was used to retrieve gutta-percha from the canals following which the canals were prepared upto size F 2 ProTaper files system (Dentsply, Konstanz, Germany). The canals were copiously irrigated using normal saline and 2% chlorhexidine. Sodium hypochlorite was avoided as it could percolate through the perforation into the periodontium. Non-setting calcium hydroxide was used as an intra-canal medicament and the pulp chamber was packed with calcium hydroxide powder and Cavit. Simultaneously the canals of tooth 47 were also prepared upto size F 2. On the subsequent visit after 7 days, the teeth 46 and 47 were obturated using the corresponding gutta-percha points and AH Plus sealer (Dentsply). The tooth 47 was coronally restored with a posterior composite (P60, 3M, ESPE).

On the next visit periodontal surgery was performed under local anesthesia. Inferior alveolar nerve block and buccal infiltration was given using 2% xylocaine hydrochloride with adrenaline (1:80,000). Before starting the surgical procedure, a 10 mL blood sample was taken from the cubital region of the forearm in a 10 ml test tube without anticoagulant and immediately centrifuged using a table-top centrifuge (REMI Laboratories, India) at 3000 rpm for 12 minutes. The resultant product consisted of following three layers: (a) RBC at the bottom, (b) PRF clot in middle and (c) upper most layers consisting of platelet poor plasma (PPP) [Figure 3]. Platelet rich fibrin (PRF) in middle clot thus obtained was carefully collected using glass rod [Figure 4].

Full thickness mucoperiosteal envelop flap was reflected from the lingual aspect of tooth 45, 46 and 47. After complete debridement, the furcation was filled with PRF gel mixed with hydroxyapatite graft material (G-Bone, Modified Hydroxyapatite Granules; Average Particle size 0.4-0.9 mm; SURGIWEAR, India) [Figure 5], and over it PRF membrane was placed. Flap was later on readapted and stabilized with sling sutures and Coepak (GC America INC., Alsip, IL, USA) was applied on operative area [Figure 6].

After completion of periodontal surgery, the perforation was repaired; using MTA to form a complete layer on the floor of the pulp chamber [Figure 7], and then the tooth was completely sealed using Type II glass ionomer cement. Written post operative instructions were given to the patient and analgesic (Ibuprofen 400 mg thrice daily) was prescribed for 3 days. Antibiotic (Amoxycillin 500 mg thrice daily) for seven days and 0.2% chlorhexidine mouth rinse was instructed for 10 days. Sutures were removed 10 days after the surgical procedure, when patient reported with uneventful healing. The teeth 46 and 47 were subsequently restored with composite resin and a full cast crown was advised for long term success. Patient was instructed to maintain meticulous oral hygiene and was recalled after every 4 weeks initially for four months and then after every three months [Figure 8]. The patient was asymptomatic when he last reported 1½

Figure 1: Preoperative radiograph of tooth 46 and 47

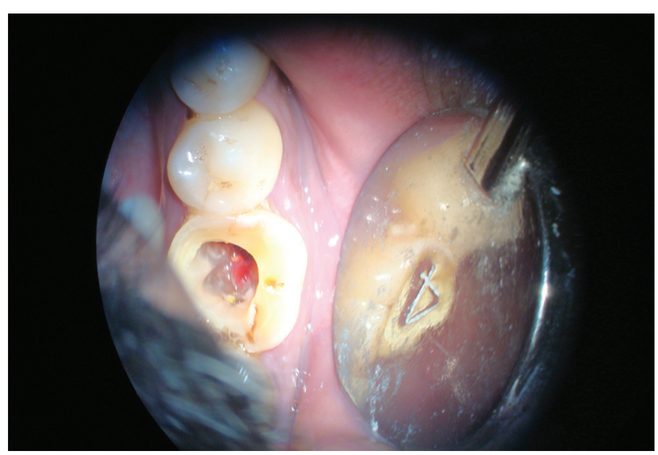

Figure 2: Pulpal floor perforation in tooth 46 under dental operating microscope

year after the treatment with significant disappearance of radiolucency on radiographs and probing depth reduction from 10 mm to 3 mm, and continues to be under active follow-up.

Figure 3: Platelet Rich Fibrin formation

Figure 5: PRF gel mixed with graft

Figure 7: Post surgical site showing MTA layer at the sub pulpal floor

Discussion

Successful treatment of grade II furcation defects includes regenerative therapy; and biological principle of guided

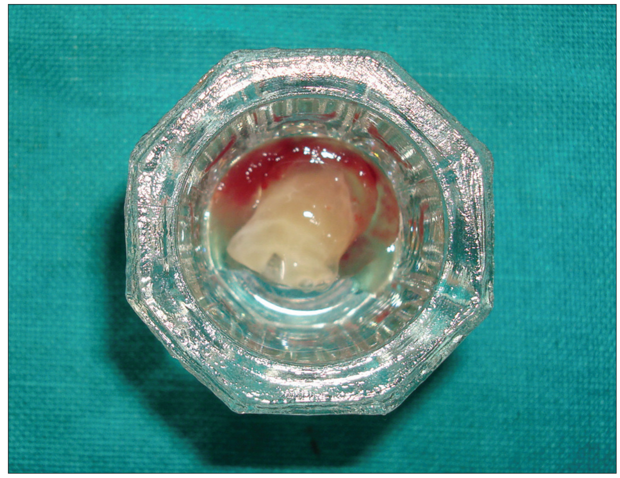

Figure 4: PRF collected in dappen dish

Figure 6: Furcation site visible after flap reflection

Figure 8: Post-operative radiograph after 4 months

tissue regeneration is routinely applied in such cases. However, when it occurs due to endodontic reasons, it becomes necessary to manage the endodontic challenge first. Unpredictable endodontic root/pulp chamber floor perforations resulting in unacceptable high rate of clinical failure has now been a lesser threat with the advent of new technologies and biocompatible materials that utilize the applications of basic research along with tissue engineering concept in clinical practice. The prognosis of a perforation defect is mostly guarded and depends on factors such as level of perforation, size of the opening; time elapsed[12] and the sealing ability and biocompatibility of the of material being used.[13]

Among the various materials used for perforation repair, MTA has been applied with good treatment outcomes owing to its properties of biocompatibility, low provocation of inflammation, good seal even in presence of moisture/blood and a high pH (12.5) which promotes growth of cementum and regeneration of periodontal ligament.[14,15] MTA is primarily composed of calcium and phosphate ions, which are also the main constituents of the dental hard tissues.[16] This resemblance in chemical composition to the tooth structure, the ability of MTA to release Ca ions and its capacity to form hydroxyapatite are stated to be the factors responsible for its sealing ability, biocompatibility and dentino-genic activity.[17] The highly biocompatible nature of MTA and its tendency to induce osteogenesis and cementogenesis makes it a suitable candidate for root perforation repair and attaining regeneration of periodontal attachment.[18]

In the present case around 4 months had lapsed since the patient first had pain and loss of attachment apparatus and bone was also evident in the furcation area as seen clinically and radio-graphically, thus the initial prognosis was questionable. The perforation was at the pulpal floor and though there was accessibility to the defect, problem was to contain the repair material within the coronal limit without encroachment of the periodontium. To prevent overfilling, sometimes, a resorbable matrix can be applied before placing MTA.[19] In in the present case, containment of the MTA was possibly achieved using platelet rich fibrin (PRF) mixed with graft. Although, no such case report or clinical trial so far has been published, however, it looks promising, as MTA is a biocompatible material, and PRF here acted as an autologous graft material, having excellent regenerative properties. Pistorius *et al,*[20] demonstrated cellular response of MTA comparable to titanium on gingival fibroblast.

Tissue-engineering-based treatment in our case report is an attempt to achieve regeneration in the grade II furcation area in conjunction with exploring the well documented cementogenetic as well as perforation sealing ability of MTA. Kanakamedala *et al,*[10] reported treatment for furcation defect with PRF and bone graft. We endeavored to utilize the collaborative property of PRF and MTA. Second generation platelet concentrate, PRF, eliminated the risk associated with the use of bovine thrombin used for preparation of autologous platelet rich plasma, as well as risk of disease transmission making it a safe treatment modality. Combination-treatment therapy utilizing autologous PRF gel (with graft) and PRF membrane results in uneventful wound healing as well as regenerative management of the furcation defect. Similarly, Marx *et al,*[21] and Kanakamedala *et al,*[10] reported respectively the increase in bone maturation in mandibular defects, and the added advantage of combined use of PRF membrane with graft. PRF membrane over mixture of PRF gel and bone graft, here probably works on the principle of GTR, facilitating improved space conducive to cellular events required for periodontal regeneration and mineralized tissue formation due to collective PRF-bone graft osteoinductive properties. Simultaneously, MTA present in the coronal pulp chamber further encourages cementogenesis while sealing the perforation.

Emdogain has also shown similar regenerative properties, however difficulties in its procurement specially in Indian sub-continent and associated cost, preclude its routine clinical usage, and hence, authors are compelled as well as motivated, to utilize an easily available, affordable, but novel autologous regenerative material, e.g. PRF. Histological events and reaction of MTA with PRF is not studied so far, however, the autologous and biocompatible nature of the components used for present treatment modalities seems to be beneficial for the long term clinical results.

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