

Nonsurgical Management of Strip Perforation Using Platelet-Rich Fibrin and MTA by Matrix Concept – A Case Report with One Year Follow-up

Abstract

Iatrogenic errors happen especially during endodontic treatment even with the experienced clinicians. It is impossible to predict the occurrence of an event. Although many of them can be corrected and managed successfully, few conditions might have the worst prognosis leading to uneventful extraction. The present case report highlights a 1-year follow-up of managed strip perforation in mesial canals of mandibular first molar, nonsurgically using MTA obturation. The present challenging case gives an insight on the importance of regenerative capacity and osteogenic potentiality of bioactive materials, when appropriate tissue engineering concepts are applied.

Keywords: Endodontics, mandibular molars, mesial canals, mineral trioxide aggregate, strip perforation

Introduction

Stripped canal or lateral perforation is an iatrogenic consequence of over instrumentation of root canals. Its occurrence is more in curved roots and thin canals, leading to the exposure with the external environment. The prognosis reported was probably poor in the past. Introduction of “Tissue Engineering Concept” in the present technology, and enhanced bioactive materials, improved the predictability of sealed strip perforations.

The prognosis of sealed stripped perforations varies and depends on various factors that ultimately dictate the outcomes of the therapy.^[1] Although perforations are caused by caries or resorption processes, the major contributory factor for a stripped perforative site is an iatrogenic consequence.^[2] The prognosis of the treated perforations usually varies depending on the duration of the perforated site and the size of perforation. Fresh perforations with smaller sizes involving coronal or apical of the attachment apparatus and have the best prognosis when intervened at the earliest.^[3,4] Usually, perforations involving the floor with larger durations and infected sites tend to have the worst prognosis even after repair of the site of perforation.

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Various materials including amalgam, zinc oxide–eugenol, IRM, glass-ionomer cement, calcium hydroxide, and MTA have been reported to be used in perforative sites.^[1] Among different *in vitro*-based studies which analyzed MTA, sealing ability proved its superiority on the fluid filtration technique,^[5] dye-leakage model,^[6] and bacterial leakage model^[7] analysis. The osteogenic potentiality and cementogenic activity lead to the predictable outcomes when used as a furcal sealing material. Especially report states, MTA has the capacity of regenerating the periodontium at the site of injury.^[8] MTA showed upregulation of interleukins (IL)-1 α , IL-1 β , and IL-6, which have a role on osteogenic activity or potentiality and bone turnover.^[9] These all factors make MTA as a suitable material of choice for sealing perforations, which are exposed with external periapical environments. Although it has excellent tissue compatibility and ideal sealing ability, the reports on the usage of MTA as an obturation material, especially for stripped perforations, are scarce.

Hence, the present case report highlights the importance of usage of MTA as a repair material for stripped perforative sites and evaluated the outcome-based data after 1-year follow-up. CARE guidelines were used for reporting the present case report as they help to reduce the bias, increase

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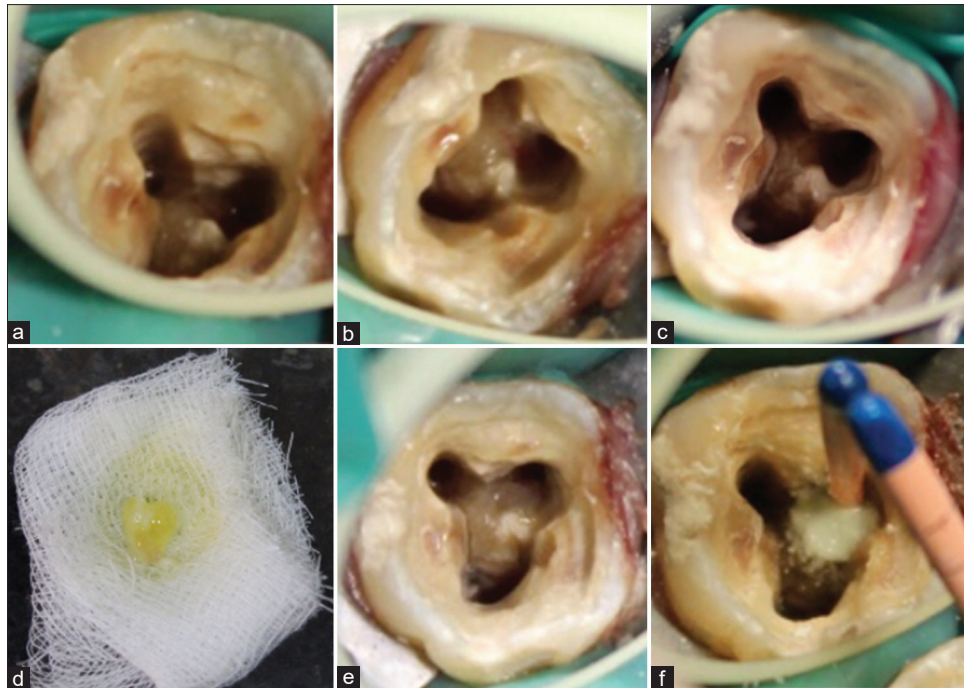


Figure 1: Clinical photographs. (a) Bleeding perforative site. (b) Mesiolingual canal after bleeding control. (c) Depicting canals before obturation (d) Collected platelet-rich fibrin. (e) Platelet-rich fibrin packed as a matrix in mesiolingual canal. (f) MTA packing in stripped mesiolingual canal

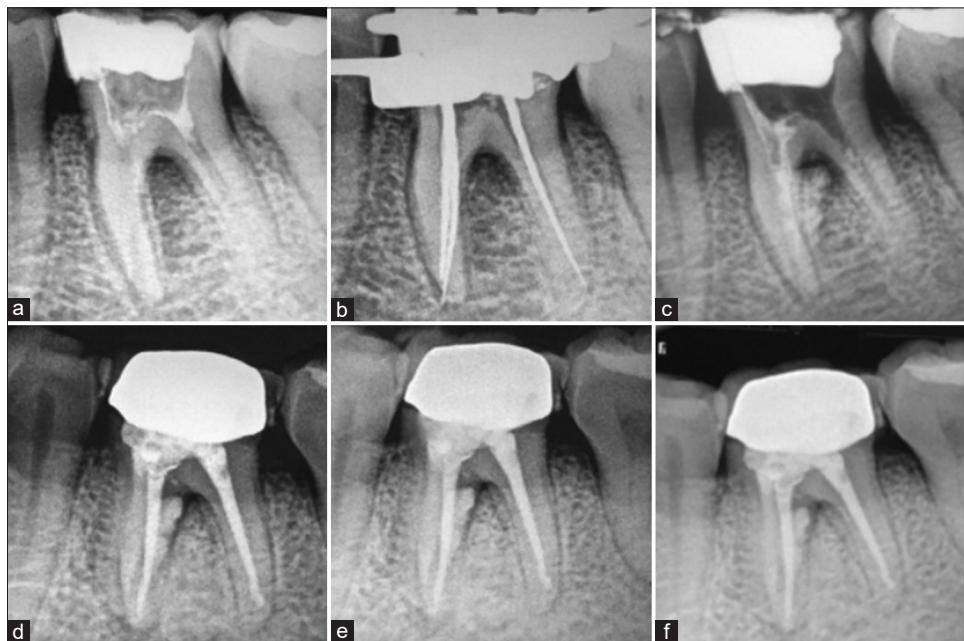


Figure 2: Radiographs. (a) Preoperative IOPA depicting stripped canal (b) Stripped canal is confirmed with working length IOPA (c) MTA packed in stripped mesiolingual canal. (d) 3 months postoperative IOPA. (e) 6 months postoperative IOPA. (f) Postoperative radiograph after 1 year

transparency, provide evidence documenting the effect of interventions, and provide feedback on the clinical practice guidelines.^[10]

Case Report

A 38-year-old female patient reported to the department of conservative dentistry and endodontics, with a chief complaint of severe pain in the left back tooth region

for 10 days. On clinical examination, the left mandibular first molar was temporarily restored which was tender on vertical percussion with no associated probing pain or tenderness on lateral percussion.

The previous operator gave a history of multiple attempts done for treating mandibular molar and failed to renegotiate the original canal path. The preoperative radiograph revealed a radiopaque material extending

into the occlusal one-third of the crown and not into the pulp chamber, suggestive of a restorative material with radiolucency involving the root canal space, break in the lamina dura continuity at the mesial furcation with radiolucency surrounding the furcal area and mesial root apex. A provisional diagnosis of pulpal necrosis with symptomatic apical periodontitis was made. Treatment plan was advised for orthograde nonsurgical root canal therapy with repair of the furcal stripped perforative site using platelet-rich fibrin (PRF) and MTA and obturation of stripped mesial canal using MTA. The prognosis and the treatment procedure and limitations were explained to the patient, and informed consent was obtained before the start of the treatment procedure.

Once the local anesthesia was administered, rubber dam isolation was done, and the temporary restoration was removed. The pulpal chamber was cleaned and disinfected using 2 ml of 2% chlorhexidine irrigant, and canals were flushed with saline. The pulpal floor was observed under dental microscope 1.0 × magnification (Carl Zeiss, OPMI pico) revealed the involvement of furcal floor near the mesiolingual canal and the canals; when accessed using 10 number Stainless Steel hand K-files (Dentsply; USA), sudden hemorrhage was seen near the mesiolingual canal suggestive of a stripped perforation.

A working length radiograph was taken with tentative measurements with mesial canals as the apex locator readings were inaccurate. Working length radiograph revealed the deviation of file along the length of the mesiolingual canal suggestive of stripped perforation. Canals are again flushed with saline dried, and an attempt for renegotiation of original canal path was attempted using 6 and 8 stainless steel hand K-files. After multiple attempts, the original path was not traceable, and it was difficult to negotiate to the complete length. Hence, canals were shaped using rotary ProTaper Gold files (Dentsply, USA), till 1 mm short of radiographic working length, and the canal disinfection was carried out using 10 ml of mild concentration of 1% sodium hypochlorite using a 30G side-vented needle taking care not to extrude. Calcium hydroxide medicament was placed into canals for three visits. In the fourth visit, once the patient was asymptomatic, irrigant activation was carried out using 5 ml of 1% sodium hypochlorite and 5 ml of 17% ethylenediaminetetraacetic acid liquid, and canals were dried.

Later to that the matrix concept was used for repairing the strip perforation in the mesiolingual canal. Autologous PRF obtained from the patient was cut into pieces and packed into the exposed perforative site, which acted as a matrix, onto which the MTA was packed, and the entire canal was plugged continuously with MTA increments until the determined working length [Figure 1]. The other canals were obturated using continuous-wave obturation technique

using gutta-percha and a bioactive sealer (Bioroot RCS). Once the obturation was done, canals were plugged with a moist cotton, and temporary restoration (RMGIC) was placed. After 2 days, once the hard set of MTA was confirmed, composite permanent restoration was done, and the prosthetic crown was delivered after 3-month follow-up. Sequentially, the patient was evaluated for 6 months and 1 year with no associated complication [Figure 2].

Discussion

Strip perforation usually occurs as an iatrogenic consequence due to improper mechanical instrumentation of the root canal. It is usually an unwanted procedural accident that has a debilitating effect on the prognosis of the treatment. Usually, the accident is more prevalent in curved root canals. Especially, the mesial buccal roots of maxillary molars and mesial roots of mandibular molars are highly prone to strip perforation if no adequate care is taken during the mechanical instrumentation. These strip perforations usually cause the mechanical trauma to the periodontal tissue, leading to the inflammation and ultimately the osseous destruction of bone. These kinds of perforations differ from other types; the major issue faced is the irregular sites and area of perforations which are larger and difficult to seal.^[11]

Most importantly, the time elapsed between the occurrence of perforation and the sealing phase plays a major role in the treatment prognosis.^[3,12] The success rate of the present case can be attributed to the two major factors: one being the time lapse which was minimal, and the site of perforation was fresh with no infection. The other major important factor is usage of autologous PRF as a matrix in an exposed perforative site, which enhanced the outcome of the present study. Studies demonstrated the release of various key growth factors including PDGF and transforming growth factor- β for at least for a week up to 28 days which is responsible for enhanced healing.^[13] PRF forms a strong fibrin matrix, which gets slowly remodeled and does not dissolve quickly.^[14] Hence, in the present case too, PRF acted as a resorbable matrix, which helped in guided tissue regeneration.

Osteoblast culture studies showed that PRF has a tendency to upregulate the phosphorylated extracellular signal-related protein kinase expression allowing the cellular infiltration and integration of newly formed tissue.^[15,16] In the present study, as there was a massive bone exposure due to strip perforation, the chances of leakage were high; we assume that the combined matrix effect of PRF and MTA induced the proliferation osteogenesis leading to an integrated environment required for healing.

Previous reports have also highlighted the importance of usage of bioceramics in both surgical and nonsurgical endodontics.^[17] To our knowledge, it is a first case report employing the tissue engineering principles based on matrix

concept using bioceramic sealer for obturation of the case. Hence, all these factors combined to create a homogeneous environment for the enhanced healing of the case. Whether the present outcome is a repair or regeneration is always a matter of debate, which can only be justified by histological assessments. The present attempted case was clinically successful even after 1-year follow-up with no associated complications.

When the limitations of the present case report have to be discussed, preoperative cone-beam computed tomography was not taken to analyze the extent of the perforation area. The other one being the shorter follow-up period, we cannot come to a generalized conclusion, especially with shorter follow-ups. Hence, the justification of the present case needs longer evaluative periods to observe the subsequent complications.

Conclusion

We conclude the successful clinical and radiographic outcomes of repaired strip perforation using tissue engineering principles and bioceramic obturation even after 1-year follow-up.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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