Case Report

Retrieval of Extruded Mineral Trioxide Aggregate Using a Novel Suction Device

Abstract

Treatment of necrotic immature permanent teeth is an exigently demanding situation for an endodontist. Regenerative endodontic procedures are being employed for such teeth in a hope to restore a functional pulp tissue and continue root development. However, currently advocated techniques may not be effective in retaining mineral trioxide aggregate (MTA) in its coronal position. The present paper describes two immature teeth with pulpal necrosis and apical periodontitis that were treated through revascularization. In both the cases, apical extrusion of the coronal MTA plug occurred. A suction tip was customized to completely retrieve the extruded material. Both cases proved out to be a clinical and radiographic success over extended follow-up periods.

Keywords: *Mineral trioxide aggregate, open apex, regenerative endodontics, revascularization*

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Introduction

Teeth with open apices pose difficulties in root canal debridement and obturation, as the root dentine is thin, weak, and prone to fracture.[1] Traditionally, the treatment for such teeth was apexification using calcium hydroxide that posed various drawbacks such as extended treatment time (average 1 year ± 7 months), uncertain apical closure, and the possibility of root fracture.[2,3] Recently, mineral trioxide aggregate (MTA) has been used as an artificial apical barrier with high success rate[4-6] but it cannot promote the maturity of apex, thickening of radicular dentin, or reduce the chances of root fracture.[7,8]

Of late, regenerative endodontic treatment has been introduced as an alternate conservative option for such teeth with better prognosis.[9] The treatment mainly involves (i) disinfection of the canal, (ii) placement of a suitable scaffold, and (iii) bacteria-tight coronal seal. This promotes repopulation of stem cells from apical papilla, regeneration of pulp tissue, and continued root development.[10] Many technical difficulties associated with the regenerative procedures such as insufficient bleeding, discoloration, lack of root development, calcifications, and empty root canal space have been reported in several publications, and their appropriate management has been discussed.[9,11,12]

However, apical displacement of coronal MTA plug adapted over the clot formed during the procedure, and its subsequent management has never been reported. The following case report presents two such conservatively managed cases that were treated successfully after the complete removal of extruded material using a chair-side fabricated suction.

Case Reports

Case report 1

A 17-year-old male patient, with a history of trauma 9 years back, presented with a chief complaint of discolored maxillary left central incisor (tooth #9) [Figure 1a]. The medical history of the patient was noncontributory. Intraoral examination revealed enamel-dentin-pulp fracture of tooth #8 and tooth #9. Both teeth were not sensitive to percussion or palpation, and electric pulp tester produced no response either. Radiographs revealed widened periodontal ligament space in tooth #8 and incomplete root formation with periapical radiolucency in relation to tooth #9 [Figure 1b]. There was no mobility or root/bone fracture. Periodontal probing depths were within normal limits. A diagnosis of pulpal necrosis with chronic apical periodontitis for both the incisors

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was made. The patient was informed about the treatment options, its risks, complications, and possible outcomes.

After obtaining written informed consent, routine endodontic treatment was carried out in tooth #8. Subsequently, for its first appointment, tooth #9 was anesthetized using 2% lidocaine with 1:1,00,000 epinephrine. After the application of a rubber dam, an access cavity was prepared. No purulent exudate or hemorrhage was observed in the canal. The canal was irrigated gently using 20 ml of 5.25% sodium hypochlorite (NaOCl) 2 mm short of the apical foramen, followed by irrigation with 5 ml of sterile saline. A final rinse of 10 ml of 2% chlorhexidine was given. The canal was carefully dried with large, sterile paper points. The root canal was medicated with triple antibiotic paste prepared by mixing equal proportions of ciprofloxacin, metronidazole, and minocycline to a cream-like consistency. The antibiotic dressing was placed into the canal to a depth 2 mm short of root apex up to the level of cementoenamel junction (CEJ). The access was sealed with a sterile cotton pellet and Cavit G.

The patient was recalled after 21 days. At this appointment, the tooth was asymptomatic. The tooth was anesthetized with an anesthetic without vasoconstrictor to prevent a restricted blood flow from the apical region. The tooth was isolated, and the medicament was removed by gently irrigating with NaOCl until no medicament was evident in the canal. The canal was further irrigated with 5 ml sterile saline, followed by 10 ml of 17% ethylenediaminetetraacetic acid (EDTA) as a final rinsing solution. Revascularization procedure was then carried out. A sterile #20 K-file was introduced into the root canal and taken 2 mm past the apical foramen to irritate the apical tissue and initiate bleeding. The intracanal hemorrhage was controlled 3 mm below the CEJ by applying pressure with a wet, sterile cotton pellet soaked in saline for approximately 15 min to establish a stable blood clot. A collacote barrier was placed above the blood clot over which MTA was packed up to the level of CEJ. A moist cotton was placed over the MTA and the access was sealed with Cavit G [Figure 1b]. The patient was recalled on the next day for the replacement of cotton and Cavit G with adhesive restoration. However, during the removal of Cavit G and moist cotton, MTA extruded apically [Figure 1c]. This extruded MTA was retrieved with a custom-made suction tip [Figure 1d]. The suction tip was constructed using a disposable suction tip and parts of intravenous infusion set. The plastic part of suction tip was removed. Latex and adaptor of the disposable infusion set were cut and attached to the suction tip, and over this, the needle was placed. The modified suction was introduced in the canal, and the dislodged MTA was removed [Figure 1e]. The revascularization procedure including disinfection of canal and introduction of intracanal bleeding and coronal sealing with MTA was repeated. After 1 month, tooth #9 was asymptomatic and nontender on percussion and palpation.

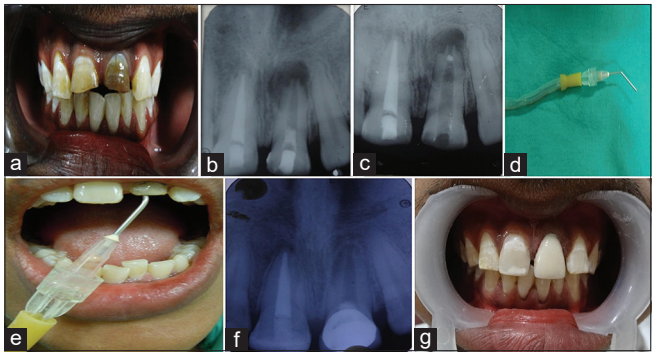

Figure 1: Case 1: (a) The initial clinical view of tooth #9. (b) Initial radiograph showing root canal treated tooth #8 and coronal mineral trioxide aggregate plug in tooth #9 after revascularization. (c) Mineral trioxide aggregate plug seen displaced apically. (d) The custom-made suction tip. (e) The fabricated suction of use in tooth #9. (f) Thirty-month radiograph showing root lengthening, closure of the wide-open apex, thickening of lateral root walls regaining the normal apical root morphology, and complete healing of periradicular lesion with the normal trabecular pattern. (g) Thirty-month intraoral view

At 30-month follow-up examination, tooth [Figure 1g] did not respond to pulp vitality test. The radiograph demonstrated the evidence of periradicular bone healing and significant root development with maturation of dentine as compared to preoperative radiograph [Figure 1f].

Case report 2

A 20-year-old male patient reported with a chief complaint of discolored left upper front tooth for 7 years. On clinical examination, tooth #9 was not sensitive to percussion or palpation and displayed Grade 2 mobility. Pulp sensibility tests yielded negative results. Radiographs revealed incomplete root formation with a wide-open apex and diffuse periapical pathology in relation to tooth #9. Based on the clinical and radiographic findings, the patient was diagnosed with asymptomatic chronic apical periodontitis.

The revascularization procedure was carried out according to the protocol mentioned in case 1. The working length was established [Figure 2a] and disinfection of the canal was carried out. Bleeding was induced into the canal [Figure 2b] and a collacote barrier was placed over it. MTA was used as a coronal plug over the collacote barrier. A moist cotton was placed over MTA and access cavity was sealed with Cavit G [Figure 2c]. The patient failed to report for a final adhesive restoration and reported after 1 month. On radiographic examination, the MTA plug was seen displaced apically [Figure 2d]. On canal reentry, it was found to be empty. After the canal was reaccessed, MTA was ultrasonically agitated to disintegrate it taking care not to touch the canal walls [Figure 2e]. A custom-made suction tip was fabricated as described previously. The disintegrated MTA was then completely retrieved using the customized suction [Figure 2f-h]. Disinfection of the canal was carried out once again using 5.25% NaOCl and 17% EDTA. The MTA was placed 3 mm cervically from the CEJ after clot formation [Figure 2i]. A final restoration

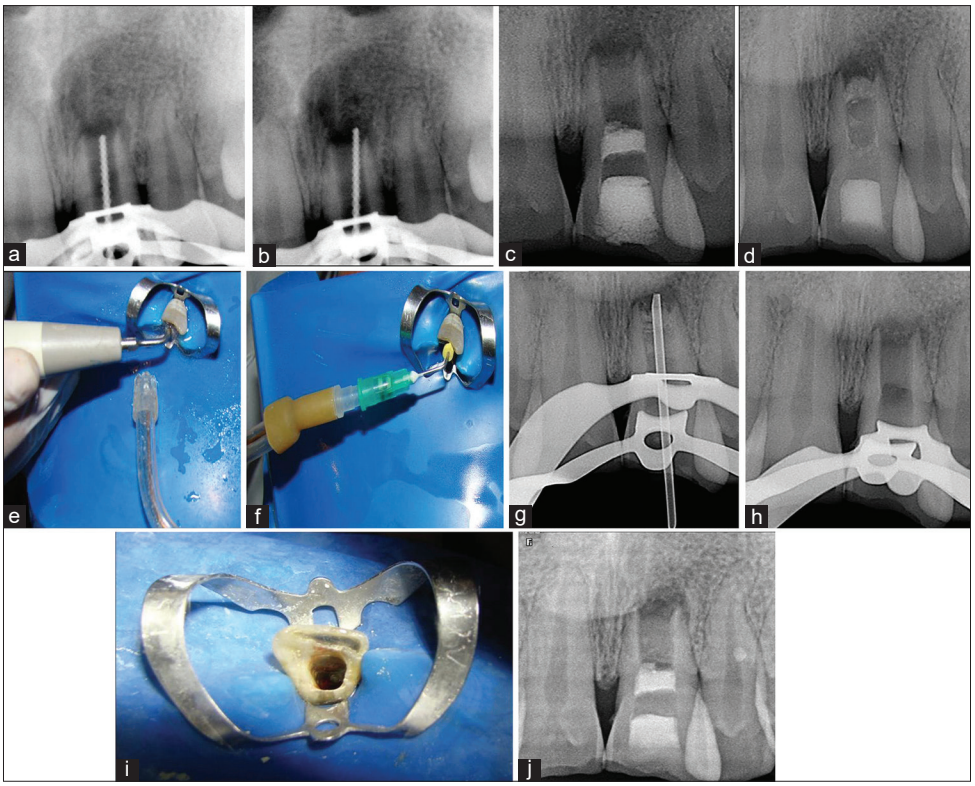

Figure 2: Case 2: (a) Working length determination.(b) K-file taken 2 mm past the apical foramen. (c) Mineral trioxide aggregate backfilled to the level of cementoenamel junction. (d) Disintegrated mineral trioxide aggregate seen in the apical region. (e) Ultrasonic agitation of the displaced mineral trioxide aggregate. (f and g) Customized suction in tooth #9 clinically and radiographically. (h) Radiograph showing complete retrieval of mineral trioxide aggregate from the periapex. (i) A stable clot after inducing bleeding in the canal. (j) One-year follow-up radiograph

of composite over 2 mm GIC was placed. A follow-up of 1 year was maintained [Figure 2j]. The tooth #9 remained asymptomatic with evident periapical healing and regained its mobility within normal limits.

Discussion

The literature available regarding regenerative endodontic procedures (REPs) is constituted mainly of case reports and case series. The technique is undeniably useful especially in cases with weak, underdeveloped roots. However, very little data are available regarding complications that may be encountered during the procedure. This paper is intended to present two untoward incidences that were encountered during revascularization. Retrieval of MTA from periapical region using custom-made suction and from apical root canal in conjunction with ultrasonics has never been reported before.

Forming a clot and maintaining its integrity during a revascularization procedure is highly technique sensitive and a difficult task. In both the cases, the dislodgement of MTA plug occurred. In case 1, the cause for its occurrence could be iatrogenic due to the application of inadvertent force to check the set of MTA. Also, it can be assumed that the blood clot formed beneath was not stable and did not provide sufficient strength to prevent the sagging of MTA. In case 2, the apical extrusion of MTA could be attributed to the fact that the blood clot broke down as a comparatively wider canal space here required a greater volume of blood and thus a bigger clot formed failed to maintain a consistent physical structure.[13] This could also be the reason behind entering into an empty pulp space during the MTA retrieval. Also, the use of matrix such as collaplug or collacote has been recommended to minimize the overextension of pulp space barrier such as MTA.[14] In our case, collacote barrier helped to prevent overextension of MTA during its placement over the blood clot but it failed to maintain it in the same position over a period of time. The use of synthetic scaffolds with high physical strength may help prevent such accidents.

MTA is chosen to be placed over the blood clot as this biocompatible cement can set in the presence of blood and is then highly resistant to bacterial penetration.[12,15,16] Apical displacement of MTA may adversely affect the coronal seal and may also hamper the new tissue growth into the root canal.[13,17] Such displacement may also suggest inadequate maturation of fibrin plug and/or void in the clot, as the three-dimensional filling of the canal with blood clot cannot be verified. We tried to clean the displaced MTA through the canal itself in an orthograde manner. A noncutting ultrasonic tip (ET 40) was used to mechanically agitate the extruded material so that its recovery could be made easy. Extreme care was observed not to touch the already fragile

canal walls during the procedure, as it could be highly detrimental to the structural integrity of the tooth. The suction tip made from the disposable infusion set allowed a good access of the periapical area. The smaller gauge needles of suitable size attached onto the fabricated suction tip provided a large bore for sucking back of MTA. The procedure was simple, efficient, less time consuming, and did not add an additional cost to the treatment.

During the follow-up period, none of the teeth showed any response to the sensibility testing. Lack of pulp response in teeth that underwent REP does not necessarily indicate a lack of vitality. According to Torabinejad *et al*., the thickness of the material used as coronal plug/seal and the coronal extent of regenerated tissue affect pulp response to sensibility testing.[18] Also, it is possible that the tissue that invaginated into the canal space was probably not innervated.

Conclusion

Based on the difficulties encountered during the above cases, it may be recommended that (1) in cases with wide canal diameters, chances of extrusion of MTA are higher as the quality of clot formation may be compromised and (2) one should consider an orthograde approach to remove the apically displaced MTA through suction.

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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