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Case Report

Access-Related Root Perforation Mishap Correction in a poorly Obturated and Apically Dilacerated Mandibular Second Premolar with a Posttreatment Disease: A Case Report with a 2-Month Follow-up

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Abstract

Introduction: Iatrogenic perforation is one of the common complications that can occur in primary treatment or retreatment and require prompt intervention. Nowadays, advancements in technologies and the use of bioactive materials promote a favorable environment for regeneration and have been successfully used for perforation repair. **Body:** A 45-year-old female patient complained of a persistent sinus and pain related to a previously endodontic-treated mandibular tooth. Clinical examination revealed the sinus tract on the buccal vestibule corresponding to mandibular second premolar. The tooth was sensitive to palpation and percussion. A panoramic radiograph showed poor, short obturation in the offending tooth. Cone Beam Computed Tomography (CBCT) was requested, which revealed gutta percha in a false canal and mid-root perforation, together with a dilacerated root and peri-apical radiolucency. Re-treatment was done under a dental operating microscope, including removing old gutta-percha using three braided Hedstrom files. CBCT helped to detect the correct canal orifice. A small, curved K-file obtained patency in the original canal. Blue Ni-Ti rotary files prepared the dilacerated root. Activated NaOCl (5.25%) disinfected the canal. Two-thirds of the canal was obturated using warm vertical compaction technique. Calcium silicate-based fast-set putty sealed the perforation. At one-week follow-up, the patient expressed no postoperative pain or swelling related to the offending tooth and healing of the sinus tract. A 2-month periapical radiograph showed a decrease in the periapical radiolucency. **Conclusion:** Properly treating iatrogenic perforation is possible using recent advancements in technologies and materials such as magnification, calcium silicate-based root repair material, proper disinfection, and canal obturation, facilitating the treatment procedures and improving the treatment outcome. However, prevention is better than treatment.

Keywords: Root perforation, Endodontic mishaps, Non-surgical root canal retreatment, CBCT, and perforation repair material.

Introduction

Tooth perforation is a pathologic or iatrogenic communication between the root canal space and the periodontium. The frequency of occurrence iatrogenic perforation ranges from 3% up to 10% (Sarao et al., 2021). The biological response of a perforated tooth is inflammatory and can cause a breakdown of the osseous and periradicular tissues. Time elapsed between perforation and repair, size, location, and the presence of the associated lesion are the most important factors affecting the prognosis (Clauder 2022).

The more apical the perforation, the better the prognosis, but the more difficult the direct repair. The immediate sealing of the perforation is important to limit communication of infection with the surrounding peri-radicular tissue. There are only two routes for managing perforations either coronal or surgery approach (Estrela et al. 2018).

Calcium silicate-based root repair materials are hydrophilic materials that can be used in many endodontic procedures to improve treatment outcomes. These materials are characterized by their biocompatibility, antibacterial activity, highly alkaline pH, and low cytotoxicity. The hydrophilic nature of these materials significantly improved their adaptation to the root wall, as they are not sensitive to moisture or blood contamination. Therefore, these materials are not technique-sensitive (Eskandari et al., 2022).

Therefore, the aim of the present report is to present the repair of access-related mid-root perforation using calcium silicate-based root repair material in the process of retreatment of a dilacerated premolar with a posttreatment disease.

Case Report

This case report has been written according to the Preferred Reporting Items for Case Reports in Endodontics (PRICE) 2020 guidelines. A 45-year-old female patient was referred to the clinic of the Department of Endodontics, Faculty of Dentistry, Cairo University. She complained of persistent sinus tract opening and pain related to a previously endodontic-treated mandibular right second premolar. The patient’s medical history was non-contributory. She had multiple restorations and previous extractions.

Clinical examination revealed a large, defective amalgam restoration with recurrent caries. The offending tooth was very sensitive to palpation and percussion tests using the back of a metal mirror. The tooth responded negatively to thermal test (Hygienic Endo-Ice Green, Coltene, OH, USA).

The panoramic radiograph presented by the patient revealed a large periapical radiolucent lesion and a radio-opaque object related to the second mandibular premolar. The root was dilacerated with a narrow root canal system (Figure 1a). To better assess the situation, the patient was asked to do a 3D cone beam computed tomography endo mode (FOV of 50×50 mm, 12.5 mA, 90 kVp, 8.7 sec, and voxel size of 85μm).

Axial view showed a loose root canal filling in a false canal that was slightly off-center towards the buccal and a lingually located, untreated original root canal space (Figure 1b). Coronal view showed misdirected gutta-percha, perforating and overextending beyond the buccal root surface at the mid-buccal aspect. A torn piece of gutta-percha was located buccally outside the root (Figure 1c). 360-degree view showed well-defined peri-apical radiolucency (Figure 1d).

Based on the patient's chief complaints, clinical and radiographic examinations, the final diagnosis was previous endodontic treatment with symptomatic apical periodontitis. Challenges were dilacerated root, a missed original canal, poor previous obturation in a false canal, and an iatrogenic mid-root, buccally oriented perforation. The treatment plan was non-surgical endodontic retreatment with intracanal perforation repair. Immediate final restoration placement would be made, and the tooth would be followed up to determine whether any persistent signs and symptoms occurred that would necessitate endodontic surgical correction. A written informed consent was obtained.

The tooth was anesthetized using 1.8 ml of 4% articaine with 1:100,000 epinephrine (Artinibsa®; Inibsa Dental, Lliçà de Vall, Spain) for mental nerve block. Afterward, the tooth was isolated using a rubber dam and liquidam. A large sterile fissure carbide bur size 3 (Dentsply Maillefer, Ballaigues, Switzerland) was used to remove defective amalgam restoration.

Under a dental operating microscope (Seiler, Seiler Instrument Inc., St. Louis, USA), the following was done: removing gutta-percha using three H-files in the braided technique. Intracanal gutta-percha was successfully removed; however, unfortunately, the peri-apically torn piece couldn't be gripped. It was decided to complete the treatment with follow-up, and in cases of persistent signs and symptoms, the torn part would be removed surgically. Guided by the axial cuts of CBCT, the correct location of the root canal could be revealed to be slightly lingual to the perforation. A tapered stone with a round end was used to open the correct location of the access cavity (Figure 2a).

To manage the dilacerated root portion; canal patency was obtained using pre-curved manual K-files 8, 10, and 15 (K-Files, MANI, INC., Industrial Park, Utsunomiya, Tochigi, Japan.) in a watch-winding motion accompanied by copious irrigation using 5.25% NaOCl. Once patency was obtained, the working length was arbitrarily measured from the CBCT and confirmed by a periapical radiograph (Figure 2b). Afterward, a glide path file (E-flex blue rotary files, eighteen; Changzhou City, China) (10/.03) was used to reach the full working length. Followed by full mechanical preparation using CM Ni-Ti rotary files (E-flex blue rotary files, Eighteen; Changzhou City, China) in the following sequence (15/.04), (20/.04), (25/.04), and (30/.04) in reciprocating motion.

Chemical disinfection was done using 5.25% NaOCl, followed by saline, and then 17% EDTA using a disposable plastic syringe with a side-ventilated needle gauge #30 (Steri irrigation tips; Diadent, Chungcheongbuk-do, Korea), reaching 1 mm shorter than the working length. The final flush was with 5.25% NaOCl, which was activated using an ultrasonic device, Ultra X (Changzhou Sifary Medical Technology, Changzhou City, China), for a total time of 10 minutes.

The master cone radiograph was done (Figure 2c). The canals were dried using a corresponding-size sterile paper point (Meta Biomed Co., Ltd., Korea). Polytetrafluoroethylene (PTFE) was placed inside the perforation (Figure 2d). About two-thirds of the canal was obturated using Ad-Seal (Meta Biomed Co., Ltd., Kore) and continuous wave compaction technique (Figure 2e) using Fi-P and Fi-E (DBA, Muenster, Germany).

To seal the perforation; PTFE was removed from the perforation and a new piece placed to occlude the canal orifice (Figure 3a). A fast-set calcium silicate-based root repair material (Neoputty, Avalon Biomed, Huston, TX, USA) was used to seal the perforation (Figure 3b). It was packed and adapted using a micro brush. A paper point was used to remove excess moisture and gently compact the material. A layer of resin-modified glass ionomer (GC Fuji IX GP Fast, Tokyo, Japan) was placed over calcium silicate-based root repair material to protect it from washing out during a restorative phase.

A fiber post was placed in the coronal one-third of the canal (Glasslx Plus, Nordin, Swiss) (Figure 3c). A self-adhesive resin cement was used for post-cementation. Selective enamel etching was done, followed by the application of universal bonding. then composite core buildup was done (Spectra ST LV, Dentsply-Sirona, USA) (Figure 3d). A post-operative periapical radiograph was taken (Figure 3e). The patient was instructed to take 400 mg of ibuprofen; if needed.

At 1-week follow-up phone call was made, and the patient reported complete resolution of all symptoms. At 2-month follow-up, a periapical radiograph was taken and showed a reduction in the periapical lesion (Figure 3f). PRICE 2020 Flowchart is presented in (figure 4).

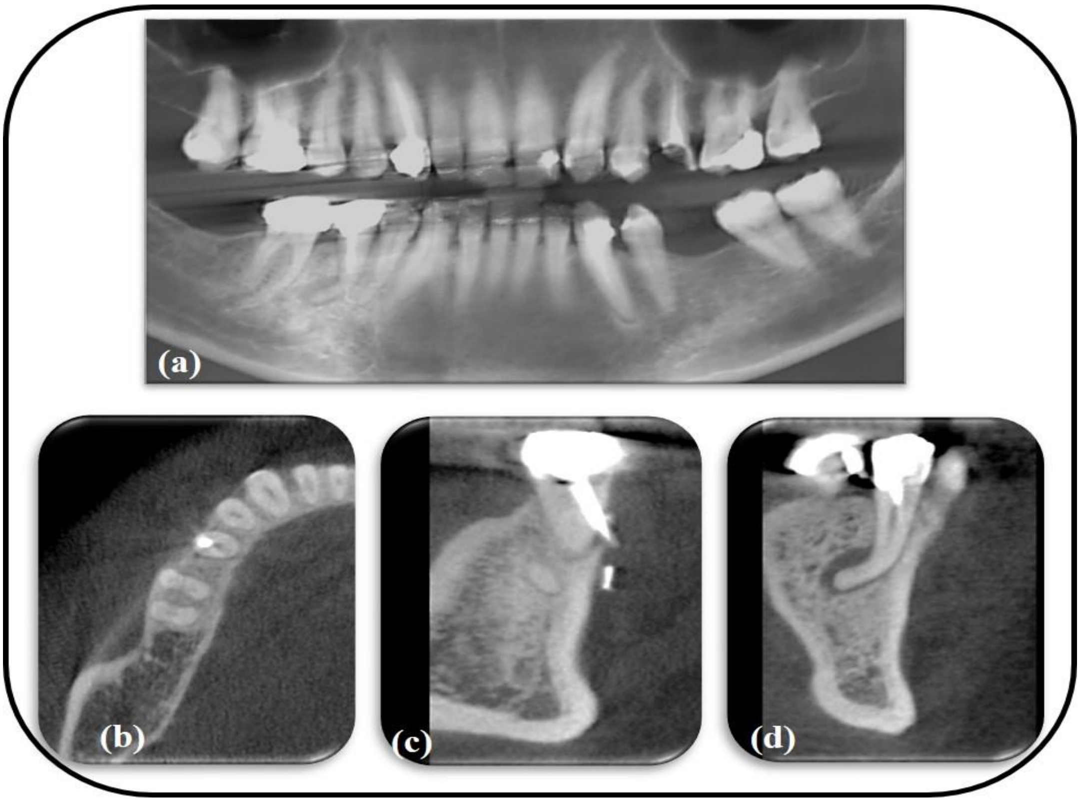

Figure (1): Radiographic examination: (a) a preoperative panoramic radiograph showing short obturation and periapical radiolucency, (b) CBCT Axial view showing root canal filling was located slightly off-center towards the Buccal aspect and lingually located un-treated root canal, (c) Coronal view showing misdirected gutta-percha perforating and overextending beyond the buccal surface of the root canal with a torn piece of gutta-percha located buccally outside the root (c)360-view showing definite peri-apical radiolucency

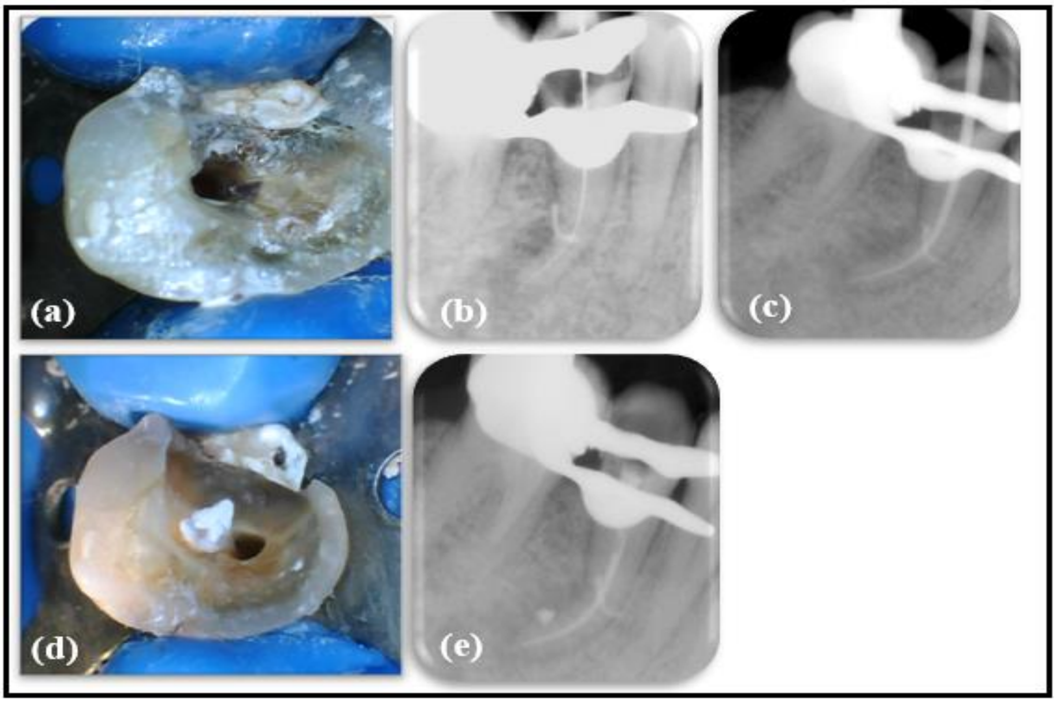

Figure (2): (a) Clinical photographs showing: Perforated mandibular premolar, (b) Radiographic examination: working length periapical radiograph, (c) Radiographic examination: Master cone periapical radiograph, (d) Clinical photographs showing: PTFE inside the perforation, and (e) Radiographic examination: Obturation periapical radiograph showing lateral canal at apical third

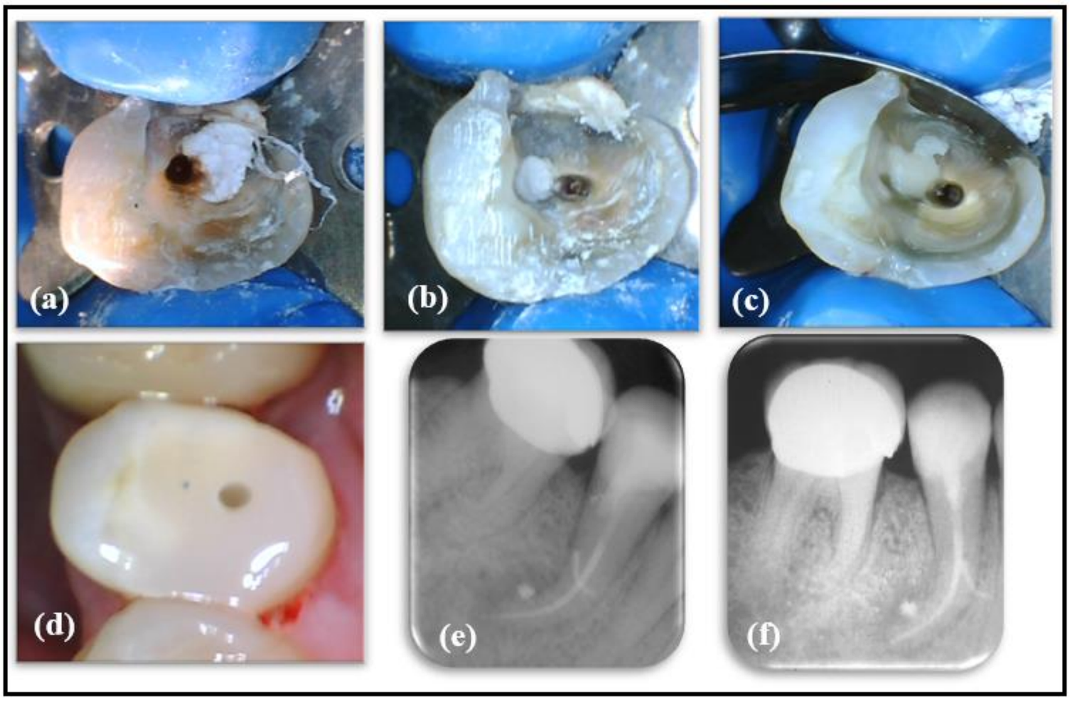

Figure (3): (a) Clinical photographs showing: PTFE plugging the canal orifice until sealing the perforation, (b) Clinical photographs showing: Perforation sealed with fast set calcium silicate-based root repair material, (c) Clinical photographs showing: Immediate placement of resin-modified glass ionomer over calcium silicate-based root repair material, and (d) Clinical photographs showing: Postoperative clinical photograph showing fiber post and resin composite restoration, (e) Radiographic examination: postoperative periapical radiograph showing radioluced area denoting place of fiber post and calcium silicate-based root repair material, and (f) Radiographic examination: 2-month follow up periapical radiograph revealing reduction in peri-apical radiolucency.

Discussion

The current case showed buccally oriented iatrogenic mid-root perforation in previously poorly obturated mandibular premolar with a dilacerated root and missed original canal. Tooth perforations are further complicated with compromised endodontic treatment, especially when a bacterial infection is allowed to be established (Tsesis and Fuss 2006).

Nonsurgical retreatment was selected because the defect was not associated with increased probing depth or attachment loss. However, in periodontal breakdown cases, additional surgical procedures for management should be planned (Clauder 2022).

In the present case report, CBCT, with a limited field of view, was performed preoperatively. The use of CBCT had a positive effect on diagnosis and treatment planning. A small FOV scan reduced the volume of exposed tissue and radiation hazards and improved image quality (Ferrari et al., 2021). It allowed revealing gutta-percha perforating the mid-buccal root surface. The CBCT images also showed a narrow root canal space with peri-apical radiolucency.

All procedures were done under a dental operating microscope DOM. This provided better visualization under good magnification and illumination and more accurate case management. The use of DOM provides high success rates when repairing a perforation site. (Clauder 2022).

In the present study, gutta-percha was removed using braided H-files to grasp and avoid gutta-percha extrusion. Working length was estimated from preoperative CBCT and confirmed using a peri-apical radiograph. Apex locators could misread the working length due to the presence of artificial communication between the root canal system and periodontium (Berman and Hargreave, 2020).

Mechanical preparation was done using blue Ni-Ti rotary files in a reciprocating motion to maintain canal centrality and reduce the possibility of canal transportation. (Gambarini et al., 2021).

In the current case report, being a retreatment case with a posttreatment disease canal, special consideration was given to proper disinfection, which was achieved by copious amounts of irrigation with 5.25% NaOCl and activated using Ultra-X, followed by saline and 17% EDTA solution (2 ml/min) for 10 minutes. Ultrasonic activation of the irrigant was previously demonstrated to achieve bacterial reduction (Abouzaid and Dhaimy, 2021).

Obturation was carried out taking care to avoid extruding the obturating material into the perforation site. Two-thirds of the canal was filled using an obtura device. Then, PTFE was placed to plug the canal orifice until the perforation was sealed.

A fast-set Calcium silicate-based root repair material was used as it showed an overall success rate of about 81%, (Kakani et al. 2019). Immediate placement of a resin-modified glass ionomer layer over calcium silicate-based root repair material was recommended to eliminate the negative effect of acid etching the repair material (Chaipattanawan et al., 2021).

Root perforations weaken the integrity of the tooth and can cause loss of the surrounding structure. However, the use of bioceramics can improve tooth structural integrity and provides a tightly sealed root canal dentine both micromechanically and chemically by forming a mineral infiltration zone (Radulica et al., 2023).

In the present case, immediate adhesive reconstruction was done because this provides less possibility for coronal leakage and strengthens the remaining tooth structure. It was found that the quality of the coronal restoration is of major importance for treatment success (Zafar et al., 2021).

The limitation of this case report is that this technique could be only beneficial in cases of iatrogenic perforations that can be accessed from coronal route and those without periodontal damage. In addition, perforation size should be considered a limitation, as large perforations might require an alternative treatment approach, such as using a biological matrix.

Conclusion

Properly treating iatrogenic perforation is possible using recent advancements in technologies and materials such as magnification, calcium silicate-based root repair material, proper disinfection, and canal obturation, facilitating the treatment procedures and improving the treatment outcome. However, prevention is better than treatment.

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