10.21608/adjc.2024.281664.1519 Advanced Dental Journal
Volume 7 (2025) | Issue 2| Pages 189-194 ©Faculty of Dentistry-Cairo University

Case Report

Management Of Iatrogenic Lateral Subcrestal Root Perforation in Maxillary First Premolar Using Bioceramic Putty: A Case Report with 4-Month Follow-Up

Safwa Essam Abdelglil[1,2]

[1] Endodontic Division, School of Dentistry, New Giza University, Egypt

[2] PhD candidate, Department of Endodontics, Faculty of Dentistry, Cairo University, Cairo Egypt

Email: safwah.essam@dentistry.cu.edu.eg

Submitted: 19-04-2024
Accepted: 05-06-2024

Abstract

Introduction: Root canal perforation refers to communication between the root canal system and the periodontium. The management and prognosis of perforations are influenced by various factors, including the level of perforation, the size of the defect, and the timing of intervention. So, the purpose of this case report is to present a conventional non-surgical endodontic retreatment of maxillary left first premolar #24 with a subcrestal coronal perforation using bioceramic Putty. **Body:** A 22-year-old male was referred by his prosthodontist for retreatment of previous root canal treatment and a perforation in access cavity in the left maxillary first premolar that was found during the preparation for a post-placement. Tooth #24 responded positively to Percussion. Radiographic examination showed unacceptable obturation being short and with inadequate taper. Based on the clinical and radiographic findings, tooth #24 was diagnosed as previously treated with symptomatic apical periodontitis. A lateral subcrestal floor perforation was detected. The perforation location was visualized using dental operating microscope DOM. The access cavity was cleaned using 2.5% NaOCl and sterile saline solution and isolated with Polytetrafluoroethylene PTTE. Previous root canal filling was removed using hand and rotary instruments. A single visit root canal retreatment was done, and perforation was repaired using bioceramic putty. Patient was referred to fixed prosthodontic department for extracoronal restoration. A 4-month follow-up revealed that the patient was asymptomatic with no periapical or periodontal pathosis. **Conclusion:** The proper sealing of recent, small-sized, subcrestal perforation with MTA bioceramic putty provided favourable prognosis. Using DOM could be useful in management of iatrogenic root perforations

Keywords: Iatrogenic, bioceramic Putty, Perforation, non-surgical retreatment.

Introduction

According to the glossary of endodontic terms root canal perforation is the communication between the root canal system and the periodontium (Endodontists, 2003). This communication can be due to pathological processes such as dental caries or root resorption. Furthermore, iatrogenic root perforations can occur mechanically during any stage of treatment, such as access cavity preparation, root canal preparation, or post-space preparation (Tsesis & Fuss, 2006).

It has been found that perforation can reduce the success rate of nonsurgical endodontic treatment and retreatment (Clauder, 2022). The management and prognosis of perforations are influenced by

various factors, including level of perforation, defect size, and the timing of intervention (Saed et al., 2016). Perforations which are equi-crestal have the worst prognosis, while those subcrestal or supracrestal have better outcomes. A small perforation is usually easier to seal and associated with more predictable healing outcomes, as they have less tissue destruction. Also, the most favourable healing is found when the perforations are sealed immediately (Saed et al., 2016). Variable materials such as bioceramics and techniques with the help of dental operating microscope DOM and MTA carrier devices have been used to aid in perforation sealing through surgical or nonsurgical approaches (Clauder, 2022). Using materials with bioactive properties as mineral trioxide aggregate (MTA) is believed to enhance the success rate of the repair procedures from 73.3% to 92% (Eyuboglu et al., 2017). This case report aims to present conventional non-surgical endodontic retreatment of a previously treated maxillary first premolar with subcrestal coronal perforation.

Case presentation

This case report has been written according to the guidelines of the Preferred Reporting Items for Case Reports in Endodontics (PRICE) 2020. A 22-year-old male patient was referred to the postgraduate clinic of the Department of endodontics, Faculty of Dentistry, Cairo University, Cairo, Egypt in November 2023 for retreatment of left maxillary first premolar for having unacceptable obturation; being short and with an inadequate taper as well as for having an access cavity related perforation. The referring dentist reported that the iatrogenic perforation was found during the preparation for a post-placement a week ago. The patient complained of slight pain on biting. No relevant medical, family or psychosocial history was reported.

Extraorally; no abnormality was detected, and lymph nodes were not tender. Intraoral examination revealed acceptable oral hygiene and a temporary restoration in tooth #24. No swelling or sinus tract was evident on the alveolar mucosa. Tooth #24 responded positively to Percussion and had no mobility. Periodontal probing was within normal limits around the suspected teeth.

A radiographic examination of a panoramic view showed a previous root canal treatment that was of inadequate taper and density. A digital periapical radiograph with bisecting angle technique was further requested. No evidence of canal obstructions was found. A slightly disrupted lamina dura was detected periapically with no evidence of periapical radiolucency. (Figure 1a).

Based on clinical and radiographic findings, the maxillary left first premolar was diagnosed as previously treated with secondary symptomatic apical periodontitis. Exploratory clinical examination was done where the temporary filling was initially removed. Visual examination of the pulpal floor (distal to palatal canal) revealed a bleeding point which indicated the presence of a small sized perforation. Dental Operating Microscope (DOM) and electronic apex locator confirmed its presence. No periodontal defect was found related to the perforation site; thus, the perforation was assumed to be recent. Probably, it could have been occurred during the post space preparation one week before the 1st visit. Furthermore, no communication was found with the oral cavity. These findings confirm subrestal location of the perforation.

All treatment options including non-surgical root canal retreatment and perforation repair surgically or non- surgically, were discussed with the patient taking into consideration the patient's desire to save the tooth. The pulp chamber was irrigated with 2.5 % NaOCl for disinfection, cotton pellet was placed followed by replacing the temporary filling. The patient was scheduled for another appointment where a single-visit non-surgical retreatment and perforation repair was planned. The perforation would be assessed and sealed based on its size and location. The patient signed a written informed consent before treatment initiation.

Treatment procedure

Treatment was done in a single visit. The tooth was anaesthetized using a buccal infiltration of 1.7 ml of articaine 4% 1:100000 epinephrine (ArtpharmaDent, Artpharma Co. for Pharmaceuticals, Egypt). Following rubber dam isolation, the temporary filling was removed. All procedures were done under Dental operating microscope (Seiler Alpha Air 6, Seiler medical, Germany). Perforation was located in the distal side of the pulp chamber floor and extending deep below the crestal bone. The perforation site was cleaned starting with Granulation tissue curettage using a sharp spoon excavator and irrigated using sterile saline solution. A resorbable collagen matrix (Collocate, Zimmer dental, Carlsbad, CA, USA) was placed inside the perforation to control the bleeding. Isolation of the perforation was done using polytetrafluoroethylene (PTTE).

Removal of Gutta percha started by using the Obturation pack handpiece (Fast Pack PRO, Changzhou Sifary Medical Technology, China) to soften and remove coronal 2-3mm to create space, to act as reservoir for natural gutta-percha solvent (Carvene, prevestden Pro, Bari Brahmana, India). Coronal one-third of the canal was achieved by M-Pro rotary file (25/.06) (IMD, China) in reciprocation motion, and manual H-file #30 (H-Files, MANI, INC., Japan) in quarter turn and pull motion, followed by M-Pro rotary file (20/.04) (IMD, China) up to two third of canal in reciprocation motion (E-connect PRO - Changzhou Sifary Medical Technology, China).

The remaining gutta-percha adhering to the canal wall was removed by using XP- endo shaper (FKG Dentaire, Switzerland) followed by 5.25 % NaOCL irrigation. The irrigant was activated using an ultrasonic device, Ultra X (Changzhou Sifary Medical Technology, China) (figure 1b).

Canal patency was achieved using several manual K-files # 8,10 and 15 (K-Files, MANI, INC., Japan). For negotiation of the palatal canal, the file with a sharp apical bend was introduced in watch-widening motion, accompanied by copious irrigation using 5.25 % NaOCl. A suspected lateral opening of the palatal canal was later confirmed after patency and Master cone radiograph. Working length determination was done using an electronic apex locator (E-PEX-Changzhou Sifary Medical Technology, China). Cleaning and shaping were done starting with Coronal flaring using E-FLEX Gold orifice opener (17/08). Apical preparation was done using E-FLEX Blue (Changzhou Sifary Medical Technology, China) used with a continuous rotation at a speed of 350 rpm and torque of 2.5 Ncm for the buccal and palatal canals to a size 35/04 and 30/04, respectively. The irrigation protocol was NaOCl 5.25 % 3 ml for 3 mins between each file with 30 G side vent needle. Final rinse was with NaOCl 2.5% 10 ml for 5 mins followed by EDTA 17% 3 ml for 3 min activation of the irrigant was done using the blue tip in Ultra X ultrasonic device (Changzhou Sifary Medical Technology, China).

The canals were dried by using a corresponding size sterile paper point (Meta Biomed Co., Ltd, Korea). Master cone verification was done using size 30/04 and 35/04 for the palatal and buccal canals; respectively (figure 1c). Obturation was done using continuous wave of compaction (CWC) with bioceramic sealer (Ceraseal, Meta Biomed Co., Ltd, Korea). Leaving the post space for the palatal canal without backfill (figure 1d). Perforation site repair was done starting with the removal of PTFE, irrigation of the pulp chamber with 2.5 % NaOCl followed by dryness with a sterile gauze. Mineral trioxide aggregate in putty form (Well-Root, Vericom, Gangwon-do, Korea) was applied till the level of the pulpal floor (Figure 1e). MTA was adapted using a micro brush. The access cavity was temporarily sealed (MD-Temp plus, Meta Biomed Co. Ltd, Korea). Clinical photographs for subcrestal perforation repair and restoration are shown in figures (2 a-d). Ibuprofen 400 mg was prescribed as a rescue medication in case any pain was felt after the treatment. The occlusal plane was adjusted to make the tooth out of occlusion. One week later, the patient was Asymptomatic and was referred to the fixed prosthodontic department for extra coronal restoration. A 4-month follow-up was scheduled, and the patient was asymptomatic. The tooth was restored with a fiber post and a

porcelain fused to metal crown that was functioning properly. No signs of periapical pathosis or periodontal defect related to root canal treatment or perforation site. (figure 1f).

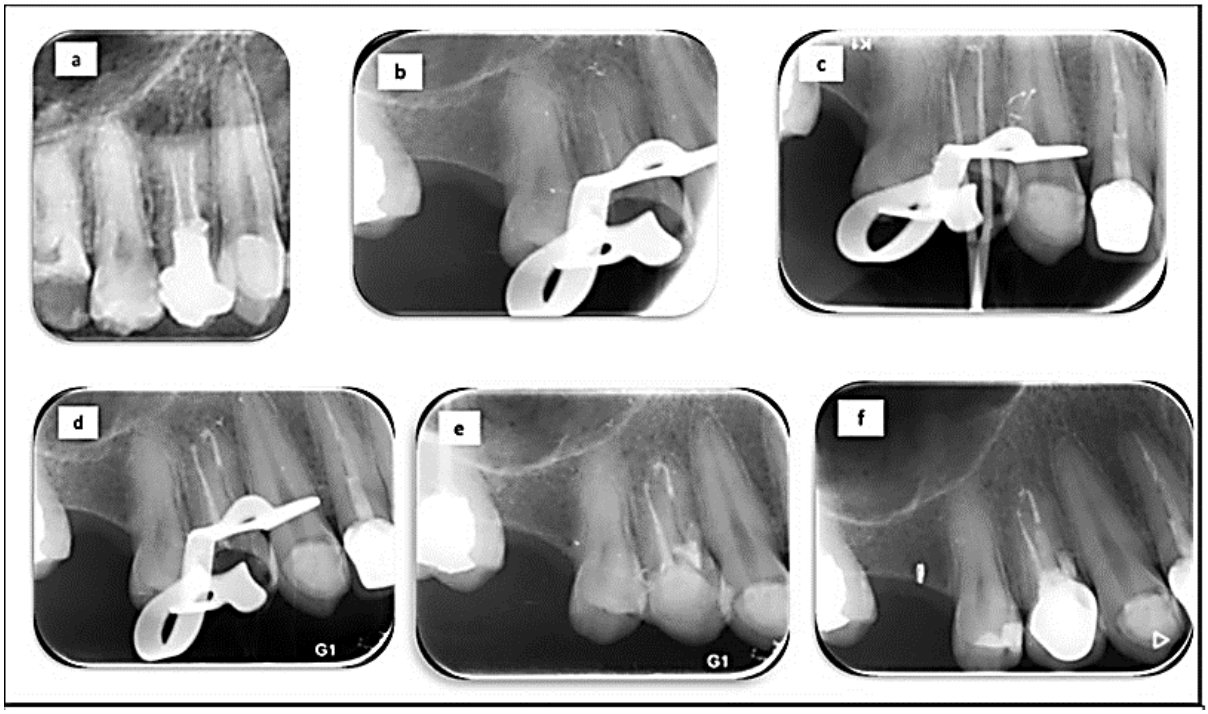

Figure 1 Radiographic panel representing the sequence of treatment steps. a) Preoperative cropped panoramic radiograph of maxillary 1st premolar with inadequate taper and density, b) Periapical radiograph after gutta-percha removal. C) Periapical radiograph for master cone verification, d) Postoperative Periapical radiograph with post space left unobturated i ealed subcrestal lateral perforation, f) 4-month raphs were taken with

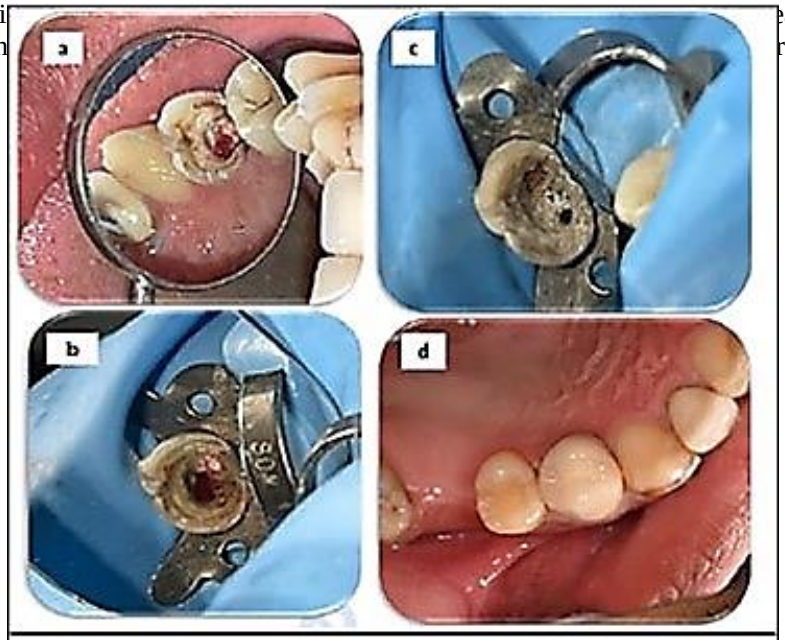

Figure 2 Clinical photographs for subcrestal perforation repair. a) Perforation detection b) Perforation site after cleaning and disinfection, c) Perforation repair using MTA putty, d) 4-month follow up after extracoronal restoration. All clinical photographs were taken using 12-megapixel ultrawide camera

Discussion

Iatrogenic perforation of the pulpal floor complicates the endodontic procedure and ultimately can lead to the loss of the tooth. In previously treated teeth, inadequate root canal treatment is commonly linked to post-treatment apical periodontitis. In the current case, non-surgical root canal retreatment was done in a single visit with a proper disinfection protocol to deal with the infected root canal. It was reported that the success rate of single-visit retreatment in cases with apical periodontitis reached up to 91% after 29 months of follow-up (Eyuboglu et al., 2017). To enhance the cleaning ability and reduce the amount of remaining gutta-percha and sealer, a combination of hand and large taper M-Pro rotary files were utilized for gutta-percha removal. Also, the additional use of XP-Endo Shaper helps in improving gutta-percha removal and cleaning efficacy (Kapasi et al., 2020)

In the current case, non-surgical perforation repair was selected as the first choice as there was no periodontal pocket associated with the defect, indicating that the perforation is recent. This was beneficial for the healing process following treatment, due to reducing the likelihood of infection around the perforation. The prompt repair after the perforation occurrence was also in favour of the prognosis(Siew et al., 2015).

Also in the current case, the perforation was located in the coronal third of the canal but below the critical zone" bone crest and epithelial attachment"; which was also in favour of good prognosis of the current case. According to the perforation site's proximity to the gingival sulcus, contamination and migration of the epithelium towards the perforation can occur. This will lead to the development of a periodontal defect which worsens the healing outcome (Menezes et al., 2005).

In the present case, the dental operating microscope was employed during the whole treatment procedure. The use of a microscope during endodontic retreatment and perforation repair can enhance the success rate of the treatment by up to 10-15%. By providing appropriate magnification, the dental operating microscope helps in achieving better visualization and precision, thus improving outcomes(Monea et al., 2015)

In this case, a collagen barrier was used to achieve homeostasis before the repair procedure(Subbaiyan & Ajitha, 2018). The perforation was also repaired using bioceramic putty without the need of a barrier due to the small size of the perforation. The perforation repair success rate is based on the achievement of a good seal of the perforation site using a biocompatible material that improves the health of the periodontium (Siew et al., 2015).

MTA putty was chosen as the perforation repair material due to its ease of handling, increased biocompatibility, increased periodontal cell attachment, cemenotinductive and osteoinductive properties and increased pH values(Dong & Xu, 2023). Several clinical studies on perforation repair with MTA including larger sample sizes and long-term follow-up are confirming high success rates ranging from 73.3% to 92% and a good long-term sealing ability (Clauder, 2022).

Conclusion

Sealing of recent, small sized, subcrestal perforation with MTA bioceramic putty provided favourable prognosis. Time elapsed and the site of perforation is the important prognostic factor for perforation repair. The use of a Dental Operating Microscope could be useful in supporting clinicians with the proper identification and management of iatrogenic root perforations.

Conflict of Interest: The authors have stated explicitly that there are no conflicts of interest in connection with this article.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors

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