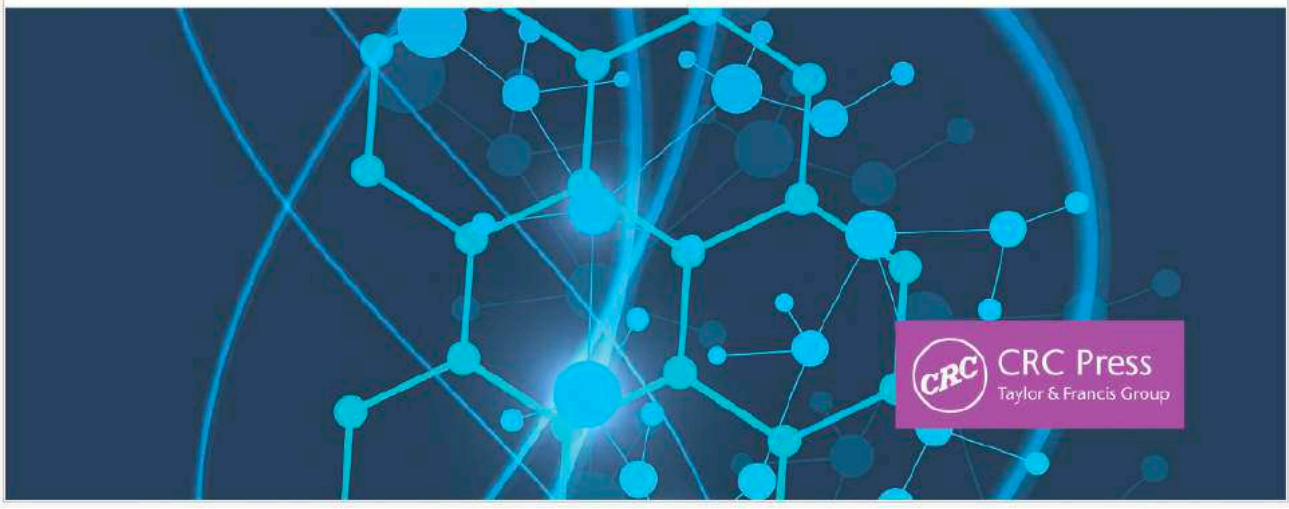
QUALITY IMPROVEMENT IN DENTAL AND MEDICAL KNOWLEDGE, RESEARCH, SKILLS AND ETHICS FACING GLOBAL CHALLENGES

Edited by
Armelia Sari Widyarman, Muhammad Ihsan Rizal,
Moehammad Orliando Roeslan & Carolina Damayanti Marpaung



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The proceedings of FORIL XIII 2022 Scientific Forum Usakti conjunction with International Conference on Technology of Dental and Medical Sciences (ICTDMS) include selected full papers that have been peer-reviewed and satisfy the conference's criteria. All studies on health, ethics, and social issues in the field of dentistry and medicine have been presented at the conference alongside clinical and technical presentations. The twelve primary themes that make up its framework include the following: behavioral epidemiologic, and health services, conservative dentistry, dental materials, dento-maxillofacial radiology, medical sciences and technology, oral and maxillofacial surgery, oral biology, oral medicine and pathology, orthodontics, pediatrics dentistry, periodontology, and prosthodontics. This proceeding will be beneficial in keeping dental and medical professionals apprised of the most recent scientific developments.

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PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON TECHNOLOGY OF DENTAL AND MEDICAL SCIENCES (ICTDMS 2022), JAKARTA, INDONESIA, 8–10 DECEMBER 2022

Quality Improvement in Dental and Medical Knowledge, Research, Skills and Ethics Facing Global Challenges

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Armelia Sari Widyarman, Muhammad Ihsan Rizal, Moehammad Orliando Roeslan and Carolina Damayanti Marpaung
Universitas Trisakti, Indonesia

CRC Press
Taylor & Francis Group
Boca Raton London New York Leiden

CRC Press is an imprint of the
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A BALKEMA BOOK

First published 2023
by CRC Press/Balkema
4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

and by CRC Press/Balkema
2385 NW Executive Center Drive, Suite 320, Boca Raton FL 33431

CRC Press/Balkema is an imprint of the Taylor & Francis Group, an informa business

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record has been requested for this book

ISBN: 978-1-032-51441-3 (hbk)
ISBN: 978-1-032-51466-6 (pbk)
ISBN: 978-1-003-40237-4 (ebk)

DOI: 10.1201/9781003402374

Typeset in Times New Roman
by MPS Limited, Chennai, India

Quality Improvement in Dental and Medical Knowledge, Research, Skills and Ethics Facing Global Challenges – Widyarman et al. (Eds)
© 2024 The Editor(s), ISBN 978-1-032-51441-3

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Preface

Faculty of Dentistry Universitas Trisakti (Usakti) presents FORIL XIII 2022 Scientific Forum Usakti conjunction with International Conference on Technology of Dental and Medical Sciences (ICTDMS) on December 8th–10th 2022. The theme of the conference is "Quality Improvement in Dental and Medical Knowledge, Research, Skills and Ethics Facing Global Challenges".

The triennial conference has served as a meeting place for technical and clinical studies on health, ethical, and social issues in field medical and dentistry. It is organized around 12 major themes, including behavioral, epidemiologic, and health services, conservative dentistry, dental materials, dento-maxillofacial radiology, medical sciences and technology, oral and maxillofacial surgery, oral biology, oral medicine and pathology, orthodontics, pediatrics dentistry, periodontology, and prosthodontics.

The most recent findings in fundamental and clinical sciences related to medical and dental research will be presented in the conference that will be published as part of the conference proceeding. This proceeding will be useful for keeping dental and medical professionals up to date on the latest scientific developments.

Dr. Aryadi Subrata
Chairman FORIL XIII conjunction with ICTDMS

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Acknowledgements

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© 2024 The Editor(s), ISBN 978-1-032-51441-3

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Quality Improvement in Dental and Medical Knowledge, Research, Skills and Ethics Facing Global Challenges – Widyarman et al. (Eds)

Management of iatrogenic problems during root canal treatment

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ABSTRACT: Background: Usually, iatrogenic problems can occur during the preparation of root canal therapy such as a broken file and perforation. The complex configuration of the root canal is one of the causes. Many strategies have been used to overcome these challenges. The common method is using a dental microscope and ultrasonic equipment to support the visualization and treatment procedures. During the broken file retrieval process, another iatrogenic error, such as a perforation of the root canal wall, could also occur. As a clinician, overcoming these problems is challenging. Case report: A 27-year-old female patient came with a chief complaint of pain in her lower left back tooth and secreted a yellowish salty fluid 1 month ago, Radiographic examination showed that there were 3 root canals and merged into 1. There were broken instruments in the apical third of the mesiobuccal canal with radiolucent lesions at the apical root. Case management: The initial steps were done by opening the access cavity, determining the working length, and the biomechanical preparation. An ultrasonic instrument was used to remove the broken file. During this process, the root canal wall perforation occurred and it was sealed with Mineral Trioxide Aggregate (MTA). The root canal obturation was done and direct composite resin restoration was chosen as a restoration. Conclusion: Sometimes, a broken file retrieval procedure can cause other iatrogenic problems. Good visualization and thorough management can support the success of the treatments.

1 INTRODUCTION

Many possible iatrogenic errors can occur during root canal treatment. Broken files because of metal fatigue, including cyclic and torsional, corrosion of the instrument in the presence of NaOCl, or a combination of these factors, are the main causes. The operator's experience, the type of NiTi alloys utilized, the type of tooth, and canal curvature are other parameters that are related to instrument separation (Boutsioukis et al. 2022). One of the biggest challenges to be overcome during endodontic treatment and one of the most common reasons for instrument breakage is the anatomical complexity of the root canal system (Loureiro et al. 2021).

When an instrument fracture occurs, the clinician should evaluate the treatment options taking into account the status of the tooth and periapical tissues, the anatomy of the root canal, the position and type of instrument fracture, and the damage that may occur. The odds of success must be balanced against potential complications. Management of endodontic broken files can be done using several approaches such as nonsurgical or surgical endodontic retreatment (Hakobyan et al. 2020). The survival rate of teeth that received nonsurgical endodontic retreatment was 85% after 72 months. The survival rate of teeth that received surgical endodontic retreatment was 88% after 72 months (Hargreaves & Cohen 2011).

DOI: 10.1201/9781003402374-37

Non-surgical endodontic retreatment can be performed by a number of techniques such as removal of the fractured segment, bypassing and sealing the fragment within the root canal space or true blockage are chosen approaches. In terms of determining success, 74 out of 90 broken instruments were removed or successfully bypassed. This resulted in an 82.2% success rate. The overall success rate was found to be 93.3% ultrasonic handpieces ultrasonic techniques were found to be more effective in removing instruments (Hakobyan et al. 2020).

Instrumentation that causes radicular transport may result in the formation of ledges, as well as canal zipping and potentially canal perforation. When the canal's curvature was higher than 20 degrees, it was noted that the incidence of ledge formation significantly increased. Continuous efforts to extend an artificial canal's working length can lead to lateral midroot perforations. Not only is MTA the preferred material for perforation repair, but it can also be used for obturation (Nosrat et al. 2021).

There is no standardized procedure for the safe and consistently successful removal of broken instruments. Previous methods and devices have shown limited success. Traditional methods are time-consuming, risky, and have limited success. Currently, they are performed by using ultrasound, operating microscopes, or microtube delivery methods (Hakobyan et al. 2020). The root canal's diameter, degree of curvature, radius of curvature, operator experience, operator fatigue, and length of the separated instrument are all factors that affect success rates, as well as the position of broken instruments. The separated instrument's visibility and accessibility are crucial for file retrieval (Nosrat et al. 2021).

2 CASE REPORT

A 27-year-old female patient complained of pain in the lower left back tooth and intermittent secretion of a yellowish, salty fluid beginning one month prior. The tooth had undergone treatment, and a temporary filling had been placed. Upon clinical examination, it was discovered that the lower left second molar had a fistula and a temporary filling that was partially opened (Figure 1a). Examinations of percussion, palpation, and mobility were all positive. A radiographic examination of the roots revealed that there were three root canals. A fragment of separated files is thought to be the radiopaque appearance in the apical part of the mesial root canal. The lamina dura is severed in the apical third and the periodontal ligament is noticeably dilated (Figure 1b). WHO diagnosed tooth 37 as having a persistent apical abscess and had previously started treatment. The treatment approach includes root canal retreatment by removal of fragments of separated files and direct composite resin restoration.

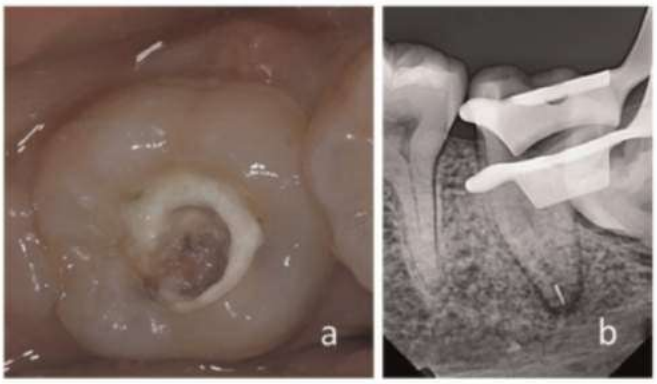

Figure 1. A. Preoperative clinical view of 36. B. Preoperative radiographic periapical.

Signing an informed consent is the first step toward treatment. The temporary filling is taken out when the tooth is isolated with a rubber dam. Using K-file #8 (Dentsply Sirona), root canal exploration was manually carried out to locate direct access to the separated file fragments. A magnification microscope (CJ Optic) and an ultrasonic motor (NEWTRON® P5 XS B.LED, ACTEON) with an endodontic tip (ET18D, ACTEON) were used in the procedure to remove the fragment of separated files. A perforation in the root canal wall resulted from an error that was made when access was being made (Figure 2a). Using k-file #8 (Dentsply Sirona) and radiography, perforation was verified (Figure 2b). Access opening is continued up until the fragment is discovered and when the fragment was loosened, the file fragment was removed using an endodontic tip (ET25, ACTEON) in a counter-clockwise motion (Figure 3a). To avoid heat accumulation caused by ultrasonic vibrations, the root canal was irrigated with aquadest during the extraction procedure. A 2mm-long separated file fragment was measured (Figure 3b). Periapical radiographs were taken to confirm the root canals again (Figure 3c). Using 37% phosphoric acid etching (DE TREY CONDITIONER 36 SYR, Dentsply Sirona) for 10 seconds, the region around the perforation was cleaned. It was then rinsed with aquadest and dried using a paper point and some light air from a three-way syringe. Perforation was sealed with mineral trioxide aggregate (ProRoot MTA Root Repair Delivery System, Dentsply Sirona) before being covered with flowable resin composite (PALFIQUE®, Tokuyama).

Figure 2. A. Perforation of the root canal wall. B. Confirmation of peroration.

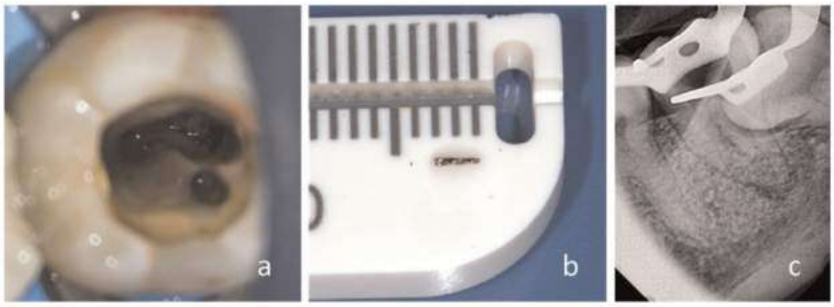

Figure 3. A. Removal fragment of separated file. B. 2mm fragment of separated file. C. Confirmation of fragment removed.

Both periapical radiographs and the apex locator were used to confirm the working length. To F2 025.06*, a rotary file (ProTaper Gold®, Dentsply Sirona) was used for root canal preparation. At each file change, irrigation was done with 5.25% NaOCl. For the final step of irrigation, 5.25% NaOCl and a sonic activator were used for activation (EndoActivator, Dentsply Sirona). K-file #15 (Dentsply Sirona) was used for apical patency, and K-file #25(Dentsply Sirona) was used for apical gauging. Periapical radiography confirmed the presence of the master gutta cone #25 (Figure 4a and b). Pastes containing calcium hydroxide ((Ca(OH)2) were used to sterilize the root canals (UltraCal XS, Ultradent).

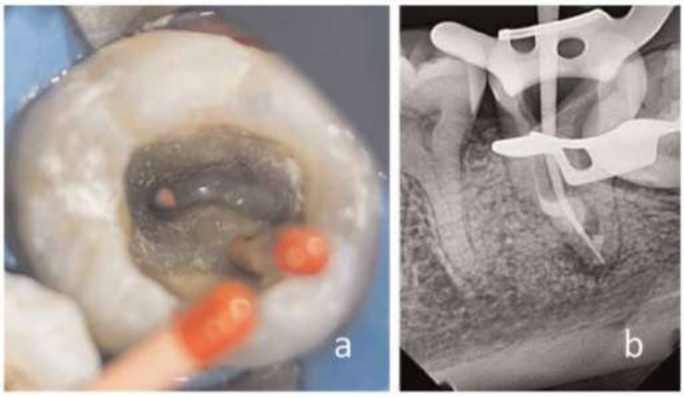

Figure 4. A. Master gutta cone #25. B. Confirmation of master gutta cone #25.

The patient had no subjective or objective symptoms at the subsequent visit, and the fistula was no longer present. Root canal cleaning with 5.25% NaOCl, 17% EDTA, and 5 ml of 2% Chlorhexidine for 2–3 minutes, changing solutions after each minute. A sonic activator was used to activate each irrigation fluid (EndoActivator, Dentsply Sirona). System B was used to obturate using a continuous wave compaction method. The gutta-percha master cone was coated with sealer before being inserted into the root canal (AH Plus Root Canal Sealer, Dentsply Sirona). Using a heat carrier system, the gutta-percha was cut to the apical 1/3, and then a hand plugger was used to compact it (Figure 5a). Using a backfill method and a hand plugger to compact it, the apical 2/3 of the orifice was obturated (Figure 5b). Radiography validated the obturation (Figure 5c).

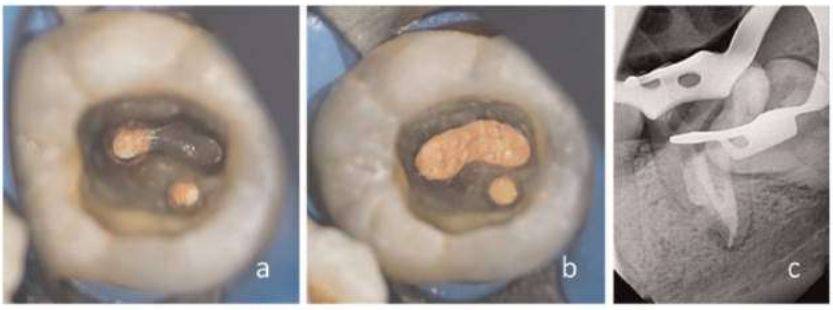

Figure 5. A. 1/3 Apical obturated. B. 2/3 Midroot obturated. C. Confirmation of root canal obturated.

Figure 6. A. Composite resin restoration. B. Finishing and polishing. C. Post operative radiographic periapical.

With a total-etch method, 37% phosphoric acid (DE TREY CONDITIONER 36 SYR, Dentsply Sirona) was used to etch the cavity's whole surface. After applying the adhesive material (Prime & Bond Universal Dentsply Sirona), it was polymerized using light curing for 20 seconds. A flowable resin composite (PALFIQUE®, Tokuyama) was used to create an orifice barrier, which was then polymerized using light curing for 20 seconds. Packable composite resin (PALFIQUE®, Tokuyama) was applied incrementally and obliquely from the bottom of the cavity to the cusp before being polymerized using a light cure for 20 seconds. Using the cusp by cusp method, build the occlusal plane to match the ideal dental morphology (Figure 6a). After removing the rubber dam, articulating paper was used to check for contact occlusion and articulation. Using a composite polisher set, polishing and finishing are performed (Figure 6b). Final periapical radiography to confirm the endodontic treatment (Figure 6c).

3 DISCUSSION

In this case, a separated instrument in the third apical region of the mesial root canal required nonsurgical treatment. Under a dental microscope, this procedure was carried out. A breakthrough in endodontic therapy has been made possible by the widespread use of the dental operating microscope. For several other medical specialties, operating microscopes have been utilized for decades: Its adoption in dentistry during the past fifteen years, particularly in endodontics, has completely changed how endodontics is carried out around the world. The operating microscope is a crucial tool for resolving a range of clinical issues and circumstances that develop during endodontic therapy (Hakobyan et al. 2020).

When a large instrument separates in the later stages of preparation, close to the working length, the prognosis is favorable. Mechanical and chemical nonsurgical treatment strategies for broken equipment can be used. There are three methods for treating a fractured instrument that has become stuck inside a canal: try to remove it surgically or non-surgically; try to bypass it; or prepare and obturate the canal with the fractured instrument. The apical part of the canals is where the majority of NiTi rotary instruments fracture (Nosrat et al. 2021). Every technique has the same issues with excessive dentin removal, weakening of the root structure, root perforation or fracture, and likely fragment extrusion (Hakobyan et al. 2020).

If the amount of dentin removed is limited and reasonable and there is no risk of lodging or perforations, a nonsurgical technique should be used (Nosrat et al. 2021). It is possible to try file removal in either a dry or wet environment. When using the dental operating microscope, dry conditions offer better visibility and reduce procedural errors (Nosrat et al.

2021). Due to excessive dentin removal from the root canal, ledge formation, over-enlargement, periapical displacement of the fractured instrument, and root canal transportation, the removal of an instrument fragment may be risky. The limited success of a file removal apical to the curve should be avoided, and there is also a higher danger of root perforation and decreased root strength (Subrata & Hardini 2019).

An ultrasonic instrument was used in this case to try to retrieve the fragment. The safest and most popular way to retrieve a separated endodontic instrument is by using ultrasonic tips magnified by a dental operating microscope. Using the ultrasonic tip to remove separated endodontic instruments has an 80% success rate (AlRahabi & Ghabbani 2020). The prepared ultrasonic tip was small enough to properly visualize the canal under a microscope as well as fit into the opening on the inner wall (Boutsioukis et al. 2022; Nosrat et al. 2021). To avoid a temperature increase and the breakage of the ultrasonic tip or the broken instrument, the ultrasonic tip was intermittently activated at the lowest power setting that allowed the least amount of dentin removal (Nosrat et al. 2021). Dry ultrasonic tips with a diamond coating were used around the fragment, and then ultrasonic vibrations with ultrasonic tips made of nickel-titanium were used to remove the fragment (Hakobyan et al. 2020).

The preparation for instrument retrieval proceeds by deepening the space until the fractured instrument is seen moving (Nosrat et al. 2021). Until the separated file is removed, push-pull motions with an ultrasonic activator should be used in the space between the separated file and the inside curvature of the canal (Nosrat et al. 2021). The retrieval procedure should start after the separated file is loosened. For the fractured instrument to flow out of the canal, there needs to be more room between it and the canal wall than it is diameter. The use of a staging platform should not be tried if the tool is separated in the curved area of the apical canal beyond the straight segment of the canal because lodging, perforation, or severe dentin loss may occur (Nosrat et al. 2021).

As a result of the canal being probably well debrided and maybe being relatively free of microorganisms, it has been suggested that instrument separation that occurs later in the canal instrumentation procedure, particularly if it occurs at the apex, has the greatest prognosis. The presence of the separated instrument should not have an impact on the prognosis if the preoperative canal is not diseased and there is no radicular periodontitis associated with the root (Nosrat et al. 2021).

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has been suggested that instrument separation that occurs later in the canal instrumentation procedure, particularly if it occurs at the apex, has the greatest prognosis. The presence of the separated instrument should not have an impact on the prognosis if the preoperative canal is not diseased and there is no radicular periodontitis associated with the root (Nosrat et al. 2021).

Another problem that occurred during the attempt to reach the fragment was lateral side perforation. When the canal system is biomechanically prepared, ledge formation is possible, especially if the canals are more curved. The instrumentation technique, instrument type, root canal curvature, tooth type, working length, master radicular file size, clinician level of experience, and canal location are just a few of the variables that might affect ledge formation. A ledged canal makes endodontic treatment challenging and may affect the prognosis. When a ledge forms, management of it will be made easier by early detection of its position using radiography and magnification (Nosrat et al. 2021).

Using a novel biocompatible material to seal the perforation site will reduce periodontal inflammation and speed up healing. MTA, which was initially marketed as a perforation repair material, was one of the first calcium silicate cement used in dentistry (Mitthra et al. 2022). Similar to this case, MTA was used to seal the mid-root perforation. MTA is a suitable material for more than just perforation repair. When there is a mid-root perforation, it can also be used as the obturation material (Nosrat et al. 2021). It can stimulate cementoblasts and induce them to create a cement matrix. It is excellent for use as a root restoration material since it is biocompatible with the periradicular tissues and exhibits a superior capacity to seal perforation sites (Hindlekar et al. 2016).

MTA is a powder composed of hydrophilic particles that are set when exposed to humidity and contain calcium silicate. Due to its several clinical uses, including root perforation, MTA was first developed as a root-end filling material. Its advantages over other materials include superior biocompatibility, efficient sealing, and the capacity to enhance

pulp and peripheral root tissue regeneration. "Hydration" is the name of the chemical process that causes hydrophilic cement to set. The hydration reaction is broken down into several parts, including mixing, sleeping, setting, cooling, and condensation. Calcium hydroxide (CaOH) and some calcium silicate hydrate (3CaOSiO2, 2CaOSiO2) are produced as a result of the hydrolysis of calcium silicate in the aqueous cement (Altan & Tosun 2016).

4 CONCLUSION

The success of treating a broken instrument depends on the shape of the root canal and the location of the fragment. It is feasible to effectively treat an apical third broken file and its complications under a dental microscope. The use of a microscope for magnification is mandatory in such cases.

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Management of Iatrogenic Problems during Root Canal Treatment

by Meiny Faudah Amin

Submission date: 08-Jan-2025 11:24AM (UTC+0700)
Submission ID: 2427490523
File name: nagement_of_Iatrogenic_Problems_during_Root_Canal_Treatment.docx (3.58M)
Word count: 2821
Character count: 15758

Management of Iatrogenic Problems during Root Canal Treatment

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ABSTRACT

Background: The most common iatrogenic problems occurring during root canal therapy happen during the preparation stage, including separating the endodontic file. One of several factors that could cause this issue is the complex configuration of the root canal. Many strategies can be used to overcome this challenge. The most common method involves using a dental microscope and ultrasonic equipment to remove file fragments. But during the process of the procedure, another iatrogenic error, such as a perforation of the root canal wall, could also occur.

Case report: A 27-year-old female patient came to RSGM Trisakti with a chief complaint of pain in her lower left back tooth and secretes a yellowish salty fluid since 1 month ago, Radiographic examination showed that there were 3 root canals and merged into 1 in the apical with a separated instrument in the third apical of mesiobuccal canals, along with radiolucent lesion at the apical of the root.

Case management: The initial steps in root canal therapy are opening the access cavity, determining the working length, and biomechanical preparation. It was decided to use an ultrasonic instrument and a dental microscope to remove the fragments non-surgically. During this process, the root canal wall is perforated. As a result, the perforation was sealed with Mineral Trioxide Aggregate (MTA), and the root canals were sterilized with Calcium Hydroxide. was done using the continuous wave compaction technique and restored by direct composite resin on the final visit.

Conclusion: Management of Broken File in Apical Third and Its Complications can be Performed sucssessfully.

Keyword : Endodontic treatment, Broken file, Perforation, MTA

BACKGROUND

In endodontics, metal fatigue, including cyclic fatigue and torsional fatigue, corrosion of the instrument in the presence of NaOCl, or a combination of these factors, are the main causes of instrument separation. The operator's experience, the type of NiTi alloys utilized, the type of tooth, and canal curvature are other parameters that are related to instrument separation. For confirmation, a radiograph is required, and the patient needs to be made aware of the accident.[1] One of the biggest challenges to be overcome during endodontic treatment and one of the most common reasons for instrument breakage is the anatomical complexity of the root canal system.[2]

Attempting to remove the instrument surgically or non-surgically, attempting to bypass, or preparing and obturating the canal with the broken instrument are the three management options for intracanal fractured instruments.[1] Numerous technique and equipment have been developed for the nonsurgical removal of a separated file. The removal of separated instruments works quite well with ultrasonic equipment. The time needed to use ultrasonic techniques varies from 3 to more than 60 minutes, and the success rate for removing fragmented files ranges from 33% to 95%. The root canal's diameter, degree of curvature, radius of curvature, operator experience, operator fatigue, and length of the separated instrument are all factors that affect success rates, as well as the position of broken instruments. The separated instrument's visibility and accessibility are crucial for file retrieval.[3]

Instrumentation that causes radicular transport may result in the formation of ledges, as well as canal zipping and potentially canal perforation. When the canal's curvature was higher than 20 degrees, it was noted that the incidence of ledge formation significantly increased.[3] Continuous efforts to extend an artificial canal's working length can lead to lateral midroot perforations. Not only is MTA the preferred material for perforation repair, but it can also be used for obturation.[1]

CASE REPORT

A 27-year-old female patient complained of pain in the lower left back tooth and intermittent secretion of a yellowish, salty fluid beginning one month prior. The tooth had undergone treatment, and a temporary filling had been placed. Upon clinical examination, it was discovered that the lower left second molar had a fistula and a temporary filling

that was partially opened (Figure 1a). Examinations of percussion, palpation and mobility were all positive. A radiographic examination of the roots revealed that there were three root canals. A fragment of separated files is thought to be the radiopaque appearance in the apical part of the mesial root canal. The lamina dura is severed in the apical third and the periodontal ligament is noticeably dilated (Figure 1b). WHO diagnosed tooth 37 as having a persistent apical abscess and had previously started treatment. The treatment approach includes root canal retreatment by removal of fragments of separated files and direct composite resin restoration.

Signing an informed consent is the first step toward treatment. The temporary filling is taken out when the tooth is isolated with a rubber dam. Using K-file #8 (Dentsply Sirona), root canal exploration was manually carried out to locate direct access to the separated files fragments. A magnification microscope (CJ Optic) and an ultrasonic motor (NEWTRON® P5 XS B.LED, ACTEON) with an endodontic tip (ET18D, ACTEON) were used in the procedure to remove the fragment of separated files. A perforation in the root canal wall resulted from an error that was made when access was being made (Figure 2a). Using k-file #8 (Dentsply Sirona) and radiography, perforation was verified (Figure 2b). Access opening is continued up until the fragment is discovered and when the fragment was loosened, the file fragment was removed using an endodontic tip (ET25, ACTEON) in a counter-clockwise motion (Figure 3a). To avoid heat accumulation caused by ultrasonic vibrations, the root canal was irrigated with aquadest during the extraction procedure. A 2mm-long separated file fragment was measured (Figure 3b). Periapical radiographs were taken to confirm the root canals again (Figure 3c). Using 37% phosphoric acid etching (DE TREY CONDITIONER 36 SYR, Dentsply Sirona) for 10 seconds, the region around the perforation was cleaned. It was then rinsed with aquadest and dried using a paper point and some light air from a three-way syringe. Perforation was sealed with mineral trioxide aggregate (ProRoot MTA Root Repair Delivery System, Dentsply Sirona) before covered with flowable resin composite (PALFIQUE®, Tokuyama).

Both periapical radiographs and the apex locator were used to confirm the working length. To F2 025.06*, a rotary file (ProTaper Gold®, Dentsply Sirona) was used for root canal preparation. At each file change, irrigation was done with 5.25% NaOCl. For the final step of irrigation, 5.25% NaOCl and a sonic activator were used for

activation (EndoActivator, Dentsply Sirona). K-file #15 (Dentsply Sirona) was used for apical patency, and K-file #25(Dentsply Sirona) was used for apical gauging. Periapical radiography confirmed the presence of the master gutta cone #25 (Figure 4a and b). Pastes containing calcium hydroxide ((Ca(OH)2) were used to sterilize the root canals (UltraCal XS, Ultradent).

The patient had no subjective or objective symptoms at the subsequent visit, and the fistula was no longer present. Root canal cleaning with 5.25% NaOCl, 17% EDTA, and 5 ml of 2% Chlorhexidine for 2-3 minutes, changing solutions after each minute. A sonic activator was used to activate each irrigation fluid (EndoActivator, Dentsply Sirona). System B was used to obturate using a continuous wave compaction method. The gutta-percha master cone was coated with sealer before being inserted into the root canal (AH Plus Root Canal Sealer, Dentsply Sirona). Using a heat carrier system, the gutta-percha was cut to the apical 1/3, and then a hand plugger was used to compact it (Figure 5a). Using a backfill method and a hand plugger to compact it, the apical 2/3 of the orifice was obturated (Figure 5b). Radiography validated the obturation (Figure 5c).

With a total-etch method, 37% phosphoric acid (DE TREY CONDITIONER 36 SYR, Dentsply Sirona) was used to etch the cavity's whole surface. After applying the adhesive material (Prime & Bond Universal Dentsply Sirona), it was polymerized using light curing for 20 seconds. A flowable resin composite (PALFIQUE®, Tokuyama) was used to create an orifice barrier, which was then polymerized using light curing for 20 seconds. Packable composite resin (PALFIQUE®, Tokuyama) was applied incrementally and obliquely from the bottom of the cavity to the cusp before being polymerized using a light cure for 20 seconds. Using the cusp by cusp method, build the occlusal plane to match the ideal dental morphology (Figure 6a). After removing the rubber dam, articulating paper was used to check for contact occlusion and articulation. Using a composite polisher set, polishing and finishing is performed (Figure 6b). Final periapical radiography to confirmed the endondtic treatment (Figure 6c).

DISCUSSION

In this case, a separated instrument in the third apical region of the mesial root canal required non-surgical treatment. Under a dental microscope, this procedure was carried out. A breakthrough in endodontic therapy has been made possible by the widespread use

of the dental operating microscope. For several other medical specialties, operating microscopes have been utilized for decades: Its adoption in dentistry during the past fifteen years, particularly in endodontics, has completely changed how endodontics is carried out around the world. The operating microscope is a crucial tool for resolving a range of clinical issues and circumstances that develop during endodontic therapy.[4]

When a large instrument separates in the later stages of preparation, close to the working length, the prognosis is favorable. Mechanical and chemical nonsurgical treatment strategies for broken equipment can be used. There are three methods for treating a fractured instrument that has become stuck inside a canal: try to remove it surgically or non-surgically; try to bypass it; or prepare and obturate the canal with the fractured instrument. The apical part of the canals is where the majority of NiTi rotary instruments fracture.[1] Every technique has the same issues with excessive dentin removal, weakening of the root structure, root perforation or fracture, and likely fragment extrusion.[4]

If the amount of dentin removed is limited and reasonable and there is no risk of lodging or perforations, a nonsurgical technique should be used.[1] It is possible to try file removal in either a dry or wet environment. When using the dental operating microscope, dry conditions offer better visibility and reduce procedural errors.[3] Due to excessive dentin removal from the root canal, ledge formation, over-enlargement, periapical displacement of the fractured instrument, and root canal transportation, the removal of an instrument fragment may be risky. The limited success of a file removal apical to the curve should be avoided, and there is also a higher danger of root perforation and decreased root strength.[5]

An ultrasonic instrument was used in this case to try to retrieve the fragment. The safest and most popular way to retrieve a separated endodontic instrument is by using ultrasonic tips magnified by a dental operating microscope. Using the ultrasonic tip to remove separated endodontic instruments has an 80% success rate.[6] The prepared ultrasonic tip was small enough to properly visualize the canal under a microscope as well as fit into the opening on the inner wall. [1,3] To avoid a temperature increase and the breakage of the ultrasonic tip or the broken instrument, the ultrasonic tip was intermittently activated at the lowest power setting that allowed the least amount of dentin removal.[1] Dry ultrasonic tips with a diamond coating were used around the fragment, and

then ultrasonic vibrations with ultrasonic tips made of nickel titanium were used to remove the fragment.[4]

The preparation for instrument retrieval proceed by deepening the space until the fractured instrument is seen moving.[1] Until the separated file is removed, push-pull motions with an ultrasonic activator should be used in the space between the separated file and the inside curvature of the canal.[3] The retrieval procedure should start after the separated file is loosened. For the fractured instrument to flow out of the canal, there needs to be more room between it and the canal wall than it is a diameter. The use of a staging platform should not be tried if the tool is separated in the curved area of the apical canal beyond the straight segment of the canal because lodging, perforation, or severe dentin loss may occur.[1]

As a result of the canal being probably well debrided and maybe being relatively free of microorganisms, it has been suggested that instrument separation that occurs later in the canal instrumentation procedure, particularly if it occurs at the apex, has the greatest prognosis. The presence of the separated instrument should not have an impact on the prognosis if the preoperative canal is not diseased and there is no radicular periodontitis associated with the root.[3]

Another problem that occurred during the attempt to reach the fragment was lateral side perforation. When the canal system is being biomechanically prepared, ledge formation is possible, especially if the canals are more curved. The instrumentation technique, instrument type, root canal curvature, tooth type, working length, master radicular file size, clinician level of experience, and canal location are just a few of the variables that might affect ledge formation. A ledged canal makes endodontic treatment challenging and may affect the prognosis. When a ledge forms, management of it will be made easier by early detection of its position using radiography and magnification.[3]

Using a novel biocompatible material to seal the perforation site will reduce periodontal inflammation and speed up healing. MTA, which was initially marketed as a perforation repair material, was one of the first calcium silicate cement used in dentistry.[7] imilar to this case, MTA was used to seal the mid-root perforation. MTA is a suitable material for more than just perforation repair. When there is a mid-root perforation, it can also be used as the obturation material.[1] It can stimulate cementoblasts and induce them to create a cement matrix. It is excellent for use as a root restoration material since it is

biocompatible with the periradicular tissues and exhibits a superior capacity to seal perforation sites.[8]

MTA is a powder composed of hydrophilic particles that are set when exposed to humidity and contain calcium silicate. Due to its several clinical uses, including root perforation, MTA was first developed as a root-end filling material. Its advantages over other materials include superior biocompatibility, efficient sealing, and the capacity to enhance pulp and peripheral root tissue regeneration. "Hydration" is the name of the chemical process that causes hydrophilic cement to set. The hydration reaction is broken down into several parts, including mixing, sleeping, setting, cooling, and condensation. Calcium hydroxide (CaOH) and some calcium silicate hydrate (3CaOSiO2, 2CaOSiO2) are produced as a result of the hydrolysis of calcium silicate in the aqueous cement.[9]

CONCLUSION

The success of treating a broken instrument depends on the shape of the root canal and the location of the fragment. It is feasible to effectively treat an apical third broken file and its complications under a dental microscope. The use of microscope for magnification is mandatory in such case.

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FIGURES

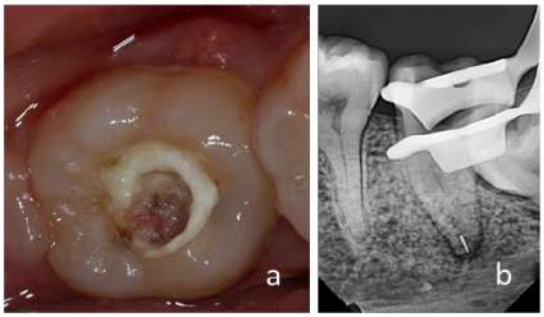

Figure 1. A. Preoperative clinical view of 36. B. Preoperative radiographic periapical.

Figure 2. A. Perforation of root canal wall. B. Confirmation of peroration.

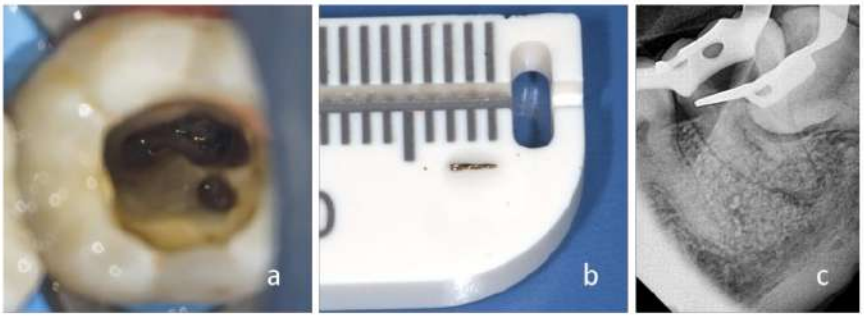

Figure 3. A. Removal fragment of separated file. B. 2mm fragment of separated file. C. Confirmation of fragment removed.

Figure 4. A. Master gutta cone #25. B. Confirmation of master gutta cone #25

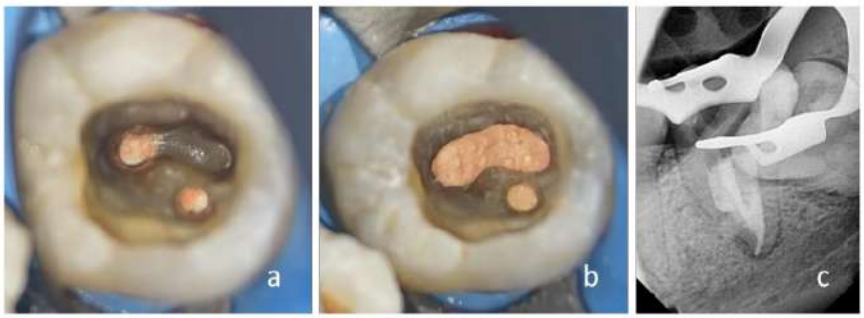

Figure 5. A. 1/3 Apical obturated. B. 2/3 Midroot obturated. C. Confirmation of root canal obturated.

Figure 6. A. Composite resin restoration. B. Finishing and polishing. C. Post operative radiographic periapical.

Management of Iatrogenic Problems during Root Canal Treatment

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