Clinical Atlas of Retreatment in Endodontics

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Contents

Foreword

Retreating an endodontic case can be quite challenging and the editor, Dr. Viresh Chopra, has masterfully categorized all the permutations of retreatment into different chapters with the emphasis on illustrating every point with his contributors.

The chapter on surgical vs nonsurgical endodontic retreatment provides a good discipline in treatment-planning. Case selection (i.e., good judgement) is a critical issue because not every case previously treated (and failing) should be retreated; sometimes extraction is indeed the better choice.

The exciting new surgical endodontic technique using a 3D template for guided osteotomy and retro sealing apexes is explained and illustrated here very well—this novel approach will become much more popular once endodontists have the equipment and training to perform these conservative and effective surgical procedures.

I applaud Dr. Chopra for editing this richly illustrated book that should be in the library of every endodontist... and a round of applause to the contributors!

Stephen Cohen
M.A., D.D.S., FICD, FACD
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Foreword

Contemporary endodontology is reliant on the sharing of evidence-based knowledge and this atlas adroitly brings together the work of a number of international contributors who are congratulated for collaboratively addressing many of the clinical considerations and challenges faced during endodontic retreatment.

The inclusion of QR codes and links to the numerous helpful clinical video clips on the companion website is of significant additional benefit in demonstrating a range of operative procedures.

As editor Dr Chopra is to be congratulated for adeptly harmonising this well illustrated resource that will no doubt serve as an excellent reference guide for general practitioners with an interest in Endodontology and in particular to postgraduate students and endodontists who wish to enhance and refine their approach to endodontic retreatment.

Rahul Arora
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Preface

When Dr. Viresh Chopra asked me to provide the Preface for his Clinical Atlas of Retreatment in Endodontics, I was very surprised. After all, the Preface is done traditionally by the author himself or herself. However, he had compelling reasons for inviting me, he said. A few years ago, he discussed with me the idea of producing a book on Endodontics. We debated the shape, the form, and the content of the intended book and identified the features that would be of most benefit to busy clinicians in practice. So the Clinical Atlas on Retreatment was born.

Retreatment is one of the most challenging areas in Endodontics. By getting contributions from a group of eminent endodontists, this Atlas has enhanced its appeal and its value by providing a broader insight into the management of these failures successfully. Here is the collective clinical experience and the wisdom of fifteen endodontists.

There are twenty-five cases presented in this Atlas, ranging from a perforation of the pulpal floor to cases with multiple failures such as inadequate obturation, fractured instrument, ledge formation in a severely curved root canal and multiple perforations. The cases are varied in their origins, nature, and complexity. The rich illustrations with their accompanying text make it easier to understand the management of these cases by the experts.

Dr. Chopra once told me that if his students cannot understand what he is trying to teach, then he has failed. Therefore, he spends a lot of time planning what and how he teaches. The same philosophy has been applied to this book.

Please read the Atlas and see for yourself. You will not be disappointed.

DYD Samarawickrama
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Acknowledgments

"If I have seen further than others, it is by standing upon the shoulders of giants."

Sir Isaac Newton

Thank you is a small word which would never completely convey the sense of gratitude and regards which I feel for each of the following colleagues who have made this *Clinical Atlas of Retreatment in Endodontics*, first edition a reality.

We all start and stay in a state of rest, or of uniform motion in a straight line, unless motivated, inspired or compelled to become active by forces/people around us. Editing this book has really been an eye opener and made me learn a lot and appreciate the presence of everyone's support around me.

First and foremost, my sincere gratitude to Prof DYD Samarawickrama for his belief in me and motivating me to make this dream a reality. Also, I would like to thank my Dean Dr. Rahul Arora, Vice Dean Dr. Nutayla Al Harthy and Prof. Mohammed Ismaily for trusting in this project and supporting me to make this dream a day.

To start is easy but to carry on is difficult. My sincere thanks to Dr. Aylin Baysan, for always sending me that positive energy and force that keep me going at all times.

I would like to take this opportunity to thank each one of my teachers who have helped me in my growth as an endodontist. With folded hands I bow forward to my *Gurus* Dr. S. Datta Prasad, Dr. Pravin Kumar, Dr. Himanshu Aeran, Dr. Vineeta Nikhil, Dr. Himanshu Sharma and Dr. Shibani Grover.

I would like to specially thank few people who have played a major role in my growth as an academician and as a clinician: Dr. Anil Kohli for always blessing me with his advice, Dr. Sanjay Miglani for being my mentor and a constant source of inspiration and support at every stage, Dr. K.S Banga for always motivating me to do better, Dr. V. Gopikrishna for always inspiring me with his wisdom and giving me one take home message in every interaction, and Dr. Vivek Hegde for always pushing me to give the best to my patients.

The actual strength of this book is the clinical contributions by eminent researchers and clinicians from across the world. I thank each one for accepting my invitation to contribute and for their kindness and generosity in sharing their knowledge and expertise.

I thank all the leading dental companies who trusted in this project and supported me for it. Thank you, Carl Zeiss, Zirc, FKG Dentaire, Coltène/Whaledent and bioMTA for your support.

I would like to thank the wonderful team at *WILEY BLACKWELL* for their genuine passion and professionalism for making this dream a reality. Thank you, Susan Engelken, Miss. Loan Nguyen, Tanya McMullin, Copyeditor Holly Regan-Jones and Mustaq Ahamed for your support.

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Oman Dental College:

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Finally, I owe my exceptional gratitude to my parents for their blessings, brother Dr. Vishal Chopra for his timely advice, wife Dr. Harneet Chopra, and children for their unflinching support.

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List of Abbreviations

MTA – Mineral Trioxide Aggregate

PDL – Periodontal ligament

IOPAR – Intraoral periapical radiograph

IANB – Inferior Alveolar Nerve Block

NaOCl – Sodium Hypochlorite

EDTA – Ethylenediaminetetraacetic acid

GP – Gutta Percha

CBCT – Cone beam computed tomography

PUI – Passive ultrasonic irrigation

About the Companion Website

This book is accompanied by a companion website:

https://www.wiley.com/go/chopra/retreatment

The website include:

- Videos

Introduction to endodontic retreatment

Sanjay Miglani, Fugen Dagli Comert, Swadheena Patro, and Viresh Chopra

There has been massive growth in endodontic treatment in recent years. The main aim of root canal treatment is to disinfect and shape the root canal system and seal it in three dimensions to prevent reinfection of the tooth [1, 2]. Although initial root canal therapy is known to be a predictable procedure with a high degree of success [3–6], failures can occur after treatment.

Literature has reported failure rates of 14–16% for initial root canal treatment [3, 7]. Lack of healing is due to persistent intraradicular infection residing in previously uninstrumented canals, dentinal tubules or in the complex irregularities of the root canal system [8–11]. The extraradicular causes of endodontic failures include periapical actinomycosis [12], a foreign body reaction due to extruded endodontic materials [13, 14], an accumulation of endogenous cholesterol crystals in the apical tissues [15] and an unresolved cystic lesion [16, 17].

The term 'retreatment' is widely used in endodontics to denote a new intervention aimed at retaining the tooth in the oral cavity [18]. Previously treated teeth with persistent periapical lesion(s) might be preserved with non-surgical retreatment or endodontic surgery, assuming the tooth is restorable and periodontally sound, and the patient wants to retain the tooth. When a decision is made to preserve the tooth, the clinician and patient face the challenge of selecting the treatment with the most beneficial long-term outcome.

Evidence-based dentistry recommends selection of alternative treatment options based on the best available evidence [19]. Intuitively, a considered medical procedure is regarded as meaningful only if it is thought to bring about some benefit to the patient. Accordingly, the consequences of treating or not treating the disease in question must be at the core of the clinical decision-making process.

I.1 Definition

According to the Glossary of Endodontic Terms of the American Association of Endodontists, retreatment [20] is defined as:

> *A procedure to remove root canal filling materials from the tooth, followed by cleaning, shaping and obturation of the root canals.*

The indications for 'root canal retreatment' given by the European Society of Endodontology [21] are:

- teeth with inadequate root canal filling with radiological findings of developing persisting apical periodontitis (apical lesion)
- teeth with inadequate root canal filling when the coronal restoration requires replacement or the coronal dental tissue is to be bleached.

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The above definitions, though correct, describe only one clinical situation of reintervention – when there is need to remove the previous root canal filling material.

Carr [22] proposed an updated and comprehensive definition of reintervention:

> *Endodontic retreatment is a procedure performed on a tooth that underwent a previous attempt at definitive treatment resulting in a condition that requires further endodontic intervention to achieve a successful outcome.*

I.2 Rationale for retreatment

Root canal system anatomy plays a significant role in endodontic success and failure [23–25]. It contains branches that communicate with the periodontal attachment apparatus furcally and laterally, and often terminate apically into multiple portals of exit [26]. Therefore, any opening from the root canal system (RCS) to the periodontal ligament space should be thought of as a portal of exit (POE) through which potential endodontic breakdown products may pass [27, 28].

There can be various causes for endodontic failures such as:

- missed canals
- pathological or iatrogenic perforations
- inadequate obturations
- inadequacies in shaping, cleaning and obturation, iatrogenic events, or reinfection of the RCS when the coronal seal is lost after completion of root canal treatment [29–32].

Regardless of all the causative factors, the final cause for failure is leakage and bacterial contamination due to inadequate debridement, disinfection or sealing of the RCS.

Success can be achieved in previously failed endodontic cases by confirming the restorability of the tooth in question, careful treatment planning and proper execution of the treatment plan. In addition, it depends upon the skill of the individual operator performing the procedure.

I.3 Aim of endodontic retreatment

The aim of retreatment is to perform an endodontic treatment that can render the treated tooth functional and comfortable again, allowing complete repair of the supporting structures. Before starting the retreatment, it is profoundly important to consider all interdisciplinary treatment options in terms of time, cost, prognosis and potential for patient satisfaction.

It is important to evaluate the endodontic failures so a decision can be made among non-surgical retreatment, surgical retreatment or extraction [33, 34, 35].

Retreatment is classified into two major groups [18].

- *Non-surgical or conventional retreatment*: the retreatment procedure is done through the root canals. Used in cases where the initial treatment is incomplete or presence of inadequate treatments diagnosed as failures.
- *Surgical retreatment*: the treatment procedure is carried out after surgical exposure of the apical portion of the tooth.

Clinicians should always opt for non-surgical retreatment over the surgical option unless a successful outcome cannot be achieved by a non-surgical approach.

With the advent of magnification and newer retreatment technologies, non-surgical retreatment procedures take care of mechanical failures, previously missed canals or radicular subcrestal fractures. Non-surgical endodontic retreatment procedures have enormous potential for success if the guidelines for case selection are respected and the most relevant technologies, best materials and precise techniques are utilized [21–23].

This book focuses on a variety of failed endodontic cases that have been treated successfully with different non-surgical as well as surgical approaches. The aim of this book is to discuss:

- different possible reasons for failure of endodontic treatment
- different ways to avoid iatrogenic errors while performing a root canal treatment
- different approaches taken to successfully retreat endodontically failed cases
- do's and don'ts during an endodontic treatment
- do's and don'ts during an endodontic retreatment
- the decision-making process between surgical and non-surgical retreatment options.

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1

Clinical Case 1 – Perforation repair: A case of repair of pulpal floor perforation caused by excessive cutting of the floor of the pulp chamber

Mohammad Hammo

Introduction to the case: pulpal floor perforation caused by excessive cutting of the floor of the pulp chamber.

1.1 Patient information

- Age: 30 years old.
- Gender: female.
- Medical history: non-contributory.

1.2 Tooth

- *Identification*: mandibular left first molar (Tooth 36).
- *Dental history*: discomfort due to impingement of food inside her molar. Previous treatment done on this tooth 1 year ago.
- *Clinical examination findings*: deep decay, tooth was filled with food remnants, no mobility, no pain to percussion. After cleaning the tooth, big perforation was noted and bleeding also.
- *Preoperative radiological assessment*: deep decay and lesion at furcation area due to perforation (Figure 1.1).
- *Diagnosis (pulpal and periapical)*: previously initiated root canal therapy with asymptomatic apical periodontitis.

1.3 Treatment plan

- *First visit*: local anaesthesia, rubber dam isolation, magnification (dental operative microscope), conventional access cavity, identification of orifices of the canals, placing cotton pellets inside them, stopping the bleeding physically with cotton pellet (Figure 1.2).
- *Treatment plan for management of the endodontic mishap*: applying MTA at the furcation area, then inserting a wet cotton pellet over MTA, temporary filling (Figure 1.3).

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Figure 1.1 Preoperative radiograph showing radiolucency in the furcation area.

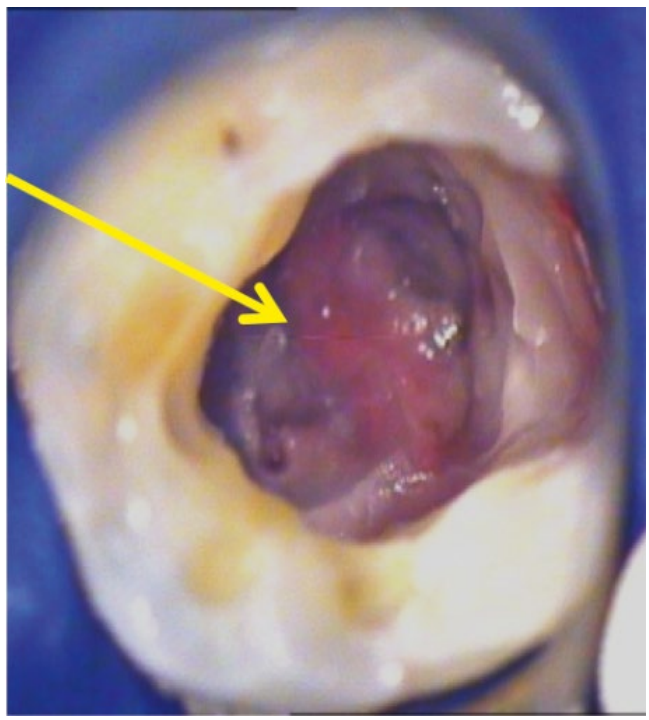


Figure 1.2 Clinical picture showing the pulpal floor perforation.

Figure 1.3 Radiograph showing MTA placed on the pulpal floor.

- *Second visit*: removing temporary filling and cotton pellets, Check the condition of MTA (hardness), canal preparation with rotary files.
- *Irrigation protocol (solution and technique)*: 5.25% NaOCl; passive sonic irrigation.
- *Final irrigation protocol*: 17% EDTA (syringe irrigation) for 1 minute.
- *Obturation (materials and technique)*: zinc oxide-based sealer (Sealite^{TM} Ultra) and gutta-percha; warm vertical compaction.
- Permanent filling (Figures 1.4 and 1.5).

1.4 Technical aspects

Key points to be taken care of while managing the endodontic mishap.

- Stop bleeding before applying MTA.
- Place wet cotton pellet over MTA and wait at least 4 hours to let it set.

1.5 Follow-up

Follow for 2.5 years. The follow-up radiograph shows formation of a bony trabecular pattern. Clinical and radiographic healing is evident on follow-up visits (Figure 1.6).

Figure 1.4 Radiograph showing master cone verification after biomechanical preparation of root canals.

Figure 1.5 Radiograph showing obturation along with intact MTA.

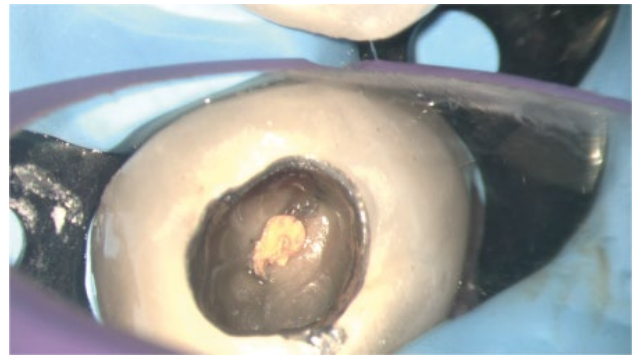


Figure 4.2 Coronal access through the metal ceramic crown showing a single cone gutta-percha obturation.

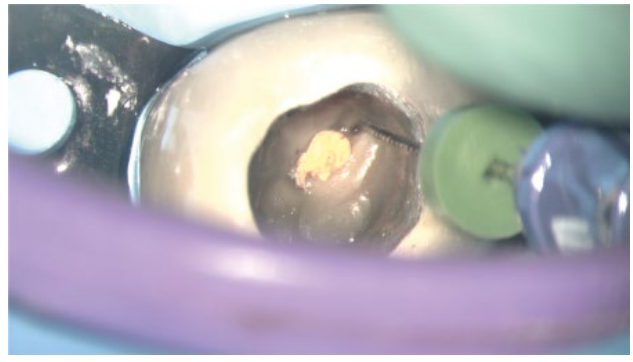


Figure 4.3 Unfilled lateral spaces around the single cone gutta-percha.

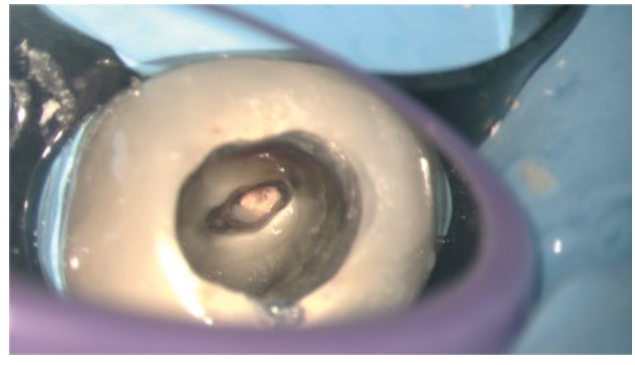


Figure 4.4 Gutta-percha removed to the middle third of the root.

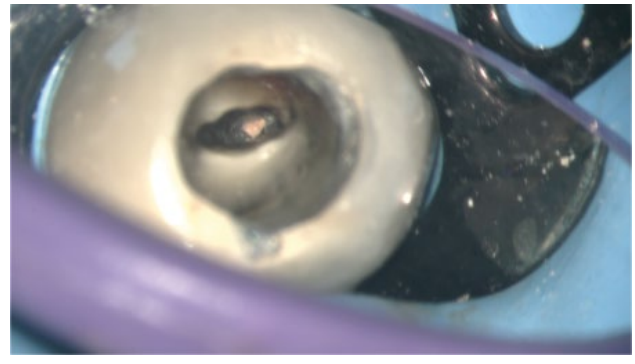


Figure 4.5 Gutta-percha removed to the the apical third of the root.

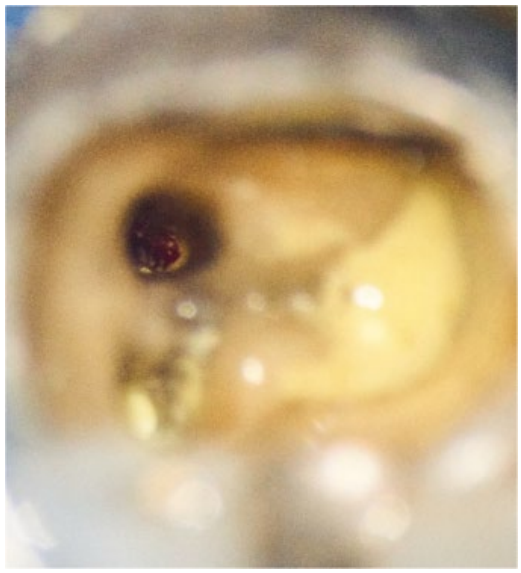


Figure 6.2 Clinical picture showing the perforation site after removal of the calcium hydroxide dressing.

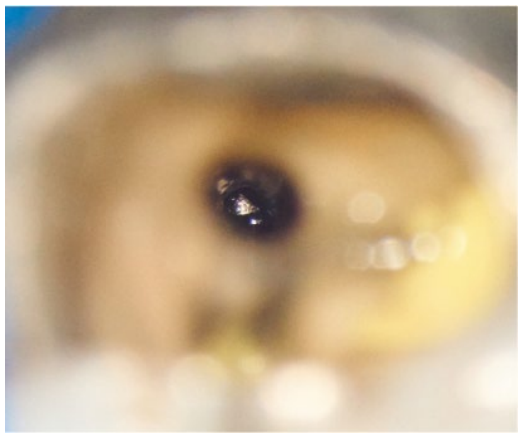


Figure 6.3 Clinical picture showing location of the fractured instrument under the microscope.

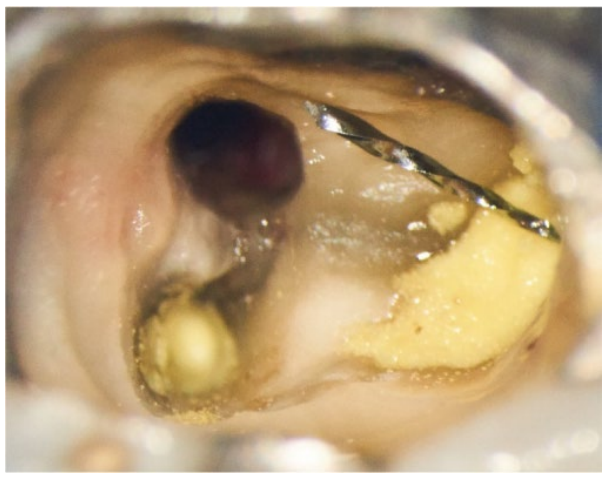


Figure 6.4 A loop retractor is used to catch and extract the instrument after it becomes loose in the canal following the use of ultrasonics.

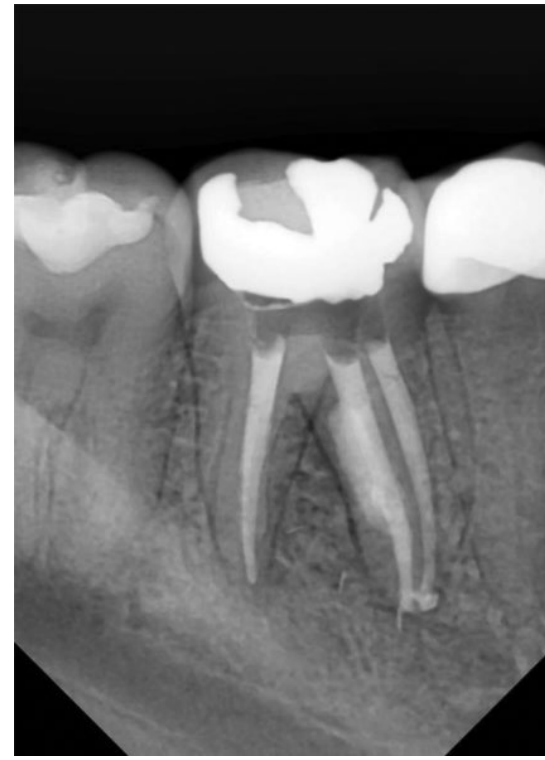


Figure 6.9 Immediate postoperative radiograph showing removal of the fractured instrument, obturation of the root canals and closure of the strip perforation with MTA.

Figure 6.10 Two-year follow-up radiograph showing complete healing of the perforation site.

6.6 Learning objectives

- Use of magnification is essential to see the perforation site as well as the fractured instrument.
- Removal of the instrument to be performed strictly under high magnification.
- First, clearly visualize the fractured instrument and then loosen the instrument and use copious irrigation to facilitate its removal from the canal.
- Avoid overcutting of dentinal walls for removal of the fractured instrument.

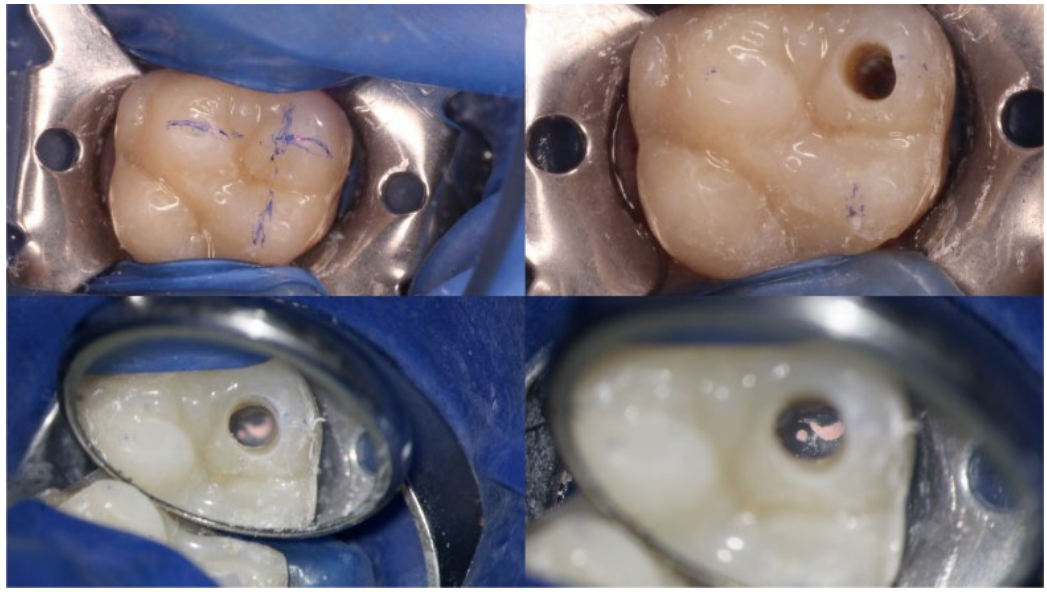


Figure 11.6 Guided access prepared without rubber dam. Previously obturated MB1 located under the microscope.

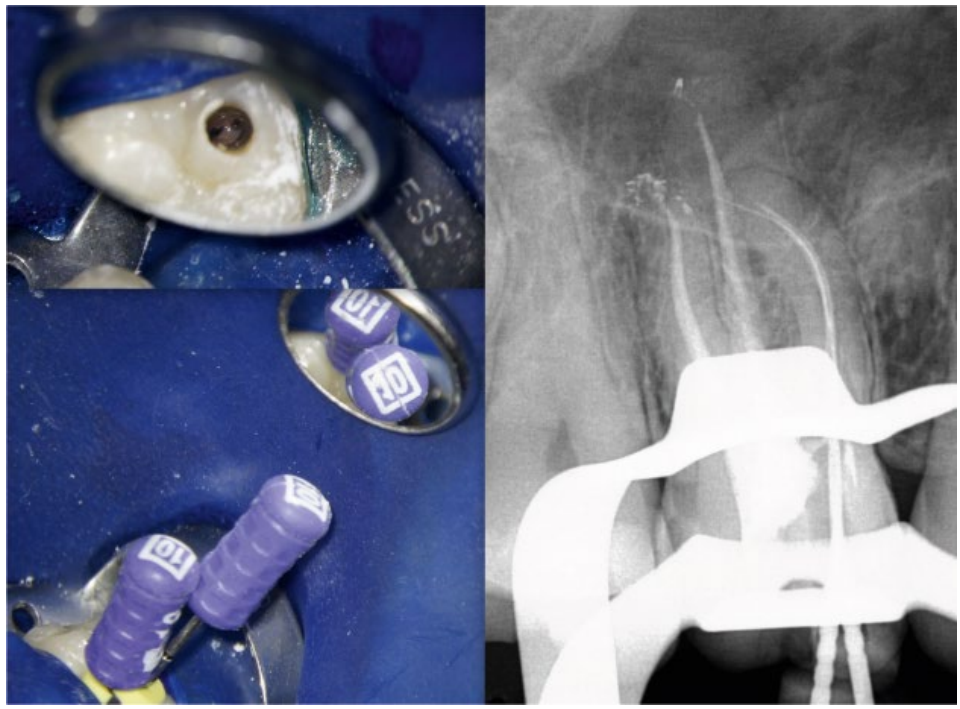


Figure 11.7 Missed MB2 discovered. 10 K file used to check canal patency. Length was controlled with an electronic apex locator and verified on periapical radiograph x-ray.

Figure 14.3 Pre-endodontic wall build-up done before starting the retreatment procedure.

unnecessary. The gutta-perchas were traced and the design of the endodontic access cavity was assessed. The access cavity was found to be inadequate and it was necessary to extend it (Figure 14.4). Minimal extension of the access cavity was done to locate the missed mesiobuccal canal (Figure 14.5).

The proper length was regained and verified with an electronic apex locator. The canal was enlarged to a 40/04 size. Disinfection was achieved with positive syringe irrigation of 5% solution of NaOCl. The missed mesiobuccal canal was cleaned and disinfected (Figure 14.6). After the canal

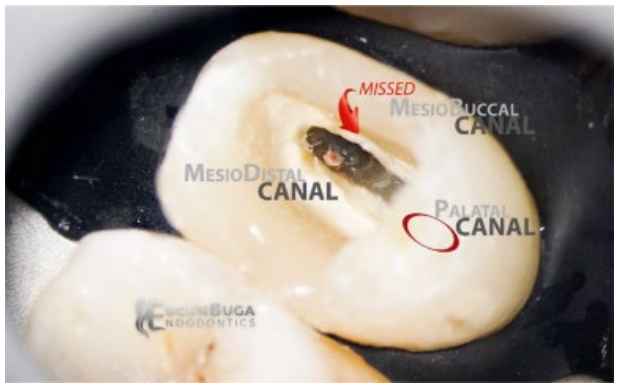


Figure 14.4 Location of suspected extra canals traced and the need for extension of the access cavity assessed. The location of a missed mesiobuccal canal is also marked.

Figure 14.5 The missed mesiobuccal canal located by minimally extending the endodontic access cavity.

Figure 16.10 Radiographic verification of the master cones up to the working length.

Figure 16.11 Final obturation with gutta-perchas.

Figure 16.12 Radiographic verification of obturation.

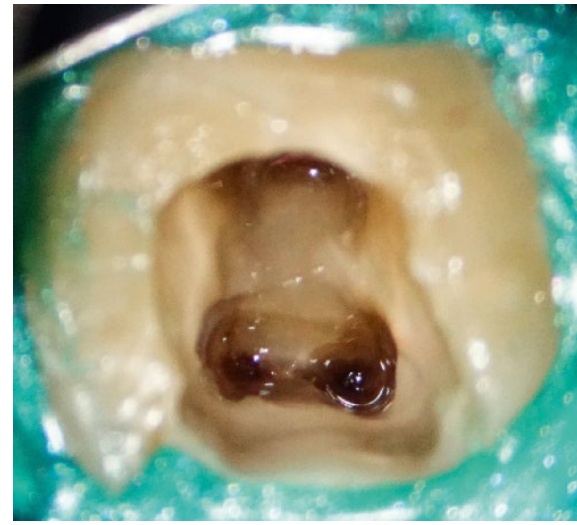


Figure 17.5 Removal of the fractured instrument in progress along with continuous flushing of the canal with irrigant.

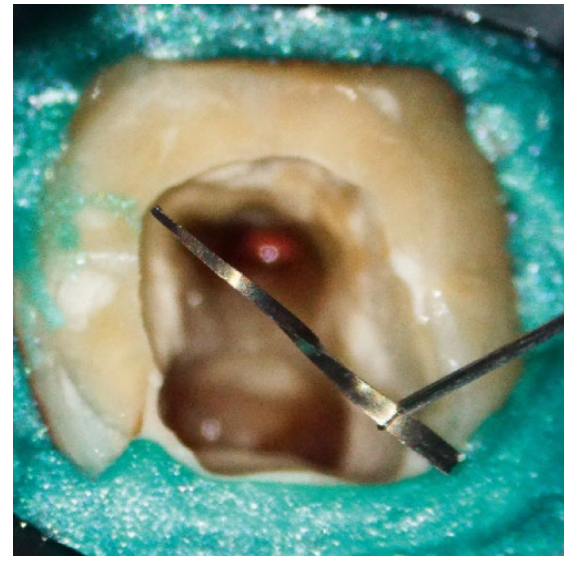


Figure 17.6 Removal of the fractured instrument with a BTR loop.

Figure 17.7 Radiographic verification of the removal of the fractured instrument.

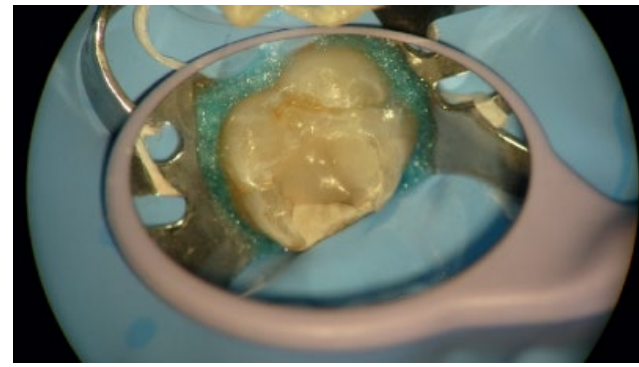
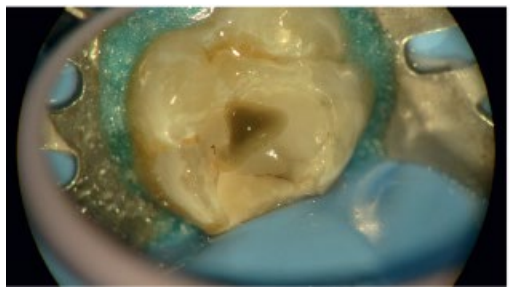


Figure 22.2 Rubber dam isolation of Tooth 16. Occlusal surface with resin composite restoration.

(a)



(b)

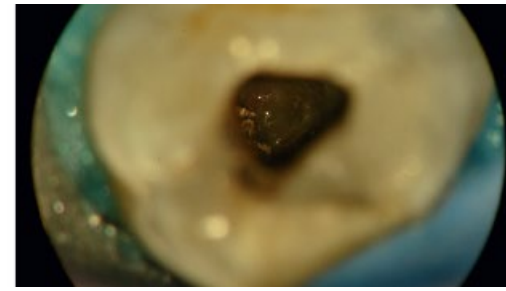


Figure 22.3 (a) Initiation of endodontic access cavity. (b) First sight of previous gutta-perchas.

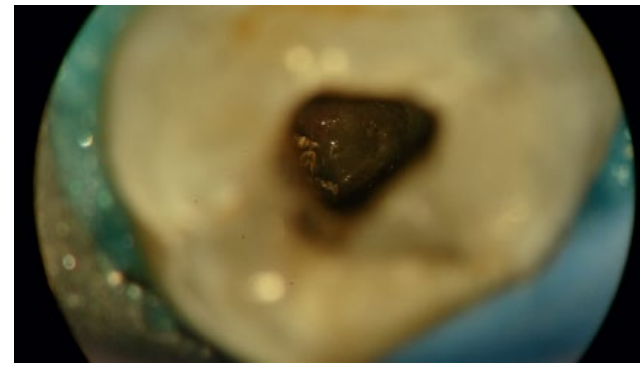


Figure 22.4 Signs of bleeding (perforation of the pulpal floor) can be seen while gaining re-entry into the pulp chamber for retreatment.

The access cavity was prepared to achieve straight-line access to the canals. Adequate care was taken not to widen the pulpal floor perforation.

Once the orifices were located, gutta-perchas were removed from the canals, taking care not to touch the perforation site (Figure 22.5). Once complete removal of gutta-percha was done and verified on the radiograph (Figure 22.6), intracanal medicament was placed inside the canals and preparation for perforation repair was carried out (Figure 22.7).

The orifices of the canals were temporarily blocked with gutta-percha, the perforations were dried and MTA mixed as per the manufacturer's instructions. MTA was placed in increments

Figure 22.8 MTA placed over the perforation site.

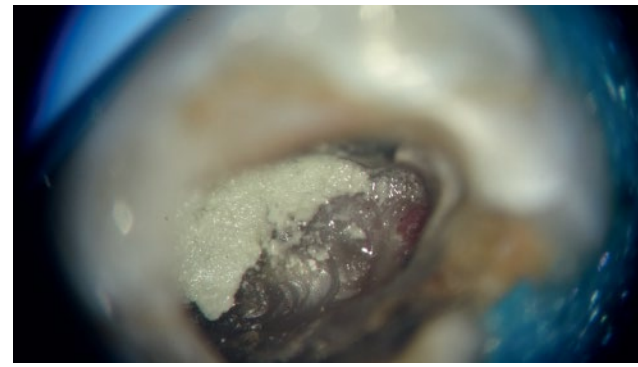


Figure 22.9 Clinical picture showing dry palatal perforation, after sealing the central perforation with MTA.

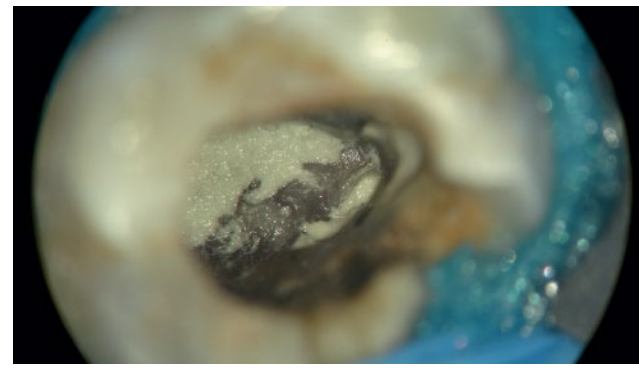


Figure 22.10 Clinical picture showing sealing of both the perforation sites with MTA.

draining sinus had subsided. The patient also felt relief on biting the tooth. The body tissues could be seen responding positively to the treatment protocol. However, on removal of the temporary filling, the MTA in the central perforation had set well but the MTA placed in the palatal perforation had dislodged completely and the site exhibited blood (Figure 22.11).

The palatal perforation was dried and placement of MTA was repeated in order to seal the perforation. A microbrush was used to condense the MTA and hydrate it in order to facilitate faster setting (Figure 22.12) (Video 4). After placing the MTA, working length was determined using an electronic apex locator and verified on a radiograph (Figure 22.13).

Figure 24.1 Palatal view.

Figure 24.2 Buccal view.

Figure 24.3 Preoperative assessment.

Figure 25.11 Preoperative soft tissue with sinus tract over the MB root.

Figure 25.12 After flap reflection, dehiscence of the cortical plate over the MB root.

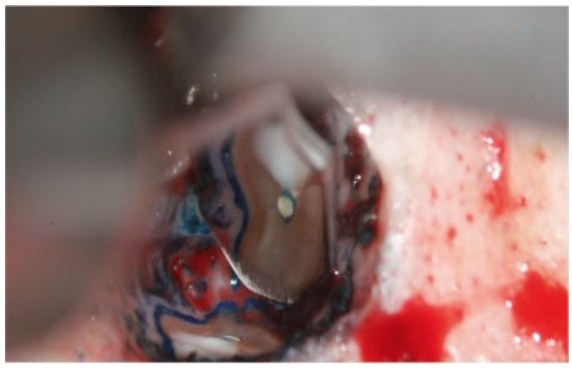


Figure 25.13 Resected root surface with methylene blue staining showing leakage around the fill and no missed anatomy.

Figure 25.14 Root-end preparation.