Republic of Iraq
Ministry of Higher Education
and Scientific Research
University of Baghdad
College of Dentistry

Endodontic Emergencies

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Conservative Dentistry in Partial Fulfillment for the Bachelor of Dental Surgery

By
Nour Aldeen Mohammed Nouri

Supervised by:
Noor Haider Fadhel
B.D.S, MSC. Restorative and Esthetic Dentistry

2023 A.D. **1444 A.H.**

Certification of the Supervisor

I certify that this project entitled **"Endodontic Emergencies"** was prepared by the fifth-year student **Nour Aldeen Mohammed Nouri** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Dr. Noor Haider Fadhel

May, 2023

Dedication

I dedicate this project to all the people that helped me through this part of my life even with a small gesture.

To my beloved family, they stood by me in all the good and bad times and provided me the ability to continue studying with the highest quality.

To my friends for being with me inside and outside the college and did their best to cheer me when I felt down.

Acknowledgement

Firstly and before anyone else, I'm so thankful to ALLAH, the almighty, for providing me the strength, patience and all blessings that made me who I am and being able to complete this work.

I want to express my thanks and respect to **"Dr. Raghad Abdul-Razaq Al-Hashimy"**, Dean of the Collage of Dentistry, University of Baghdad for his support to the research student's program.

I would like to thank **"Dr. Anas Falah Mahdee"**, the head of Conservative and Aesthetic Dentistry for its scientific support, encouragement and advice.

I would like to give my special deep thanks to my supervisor **"Dr. Noor Haider Fadhel"**, who has been kind to me, gave away from her time to answer my questions and supported me. It was a great honor to work under her guidance.

Finally, I want to express my gratitude to all the seniors that nourished my mind with great information and tips about Dentistry.

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Introduction

All dentists and endodontists must be able to manage patients who present with a dental emergency. Emergencies usually involve pain as a result of inflammation, but they can also involve swelling and other signs of infection. The aim of this review is to provide an overview of endodontic emergencies.In this review, the term ‘endodontic treatment’ has been used to include all possible treatments for pulp, root canal and periradicular conditions—these include indirect pulp capping, direct pulp capping, partial pulpotomy, pulpotomy, pulpectomy with root canal treatment, root canal re-treatment and periradicular surgery. The term ‘root canal treatment’ has been used to specifically refer to pulpectomy and its associated procedures to clean, disinfect and fill the root canals **(Abbott, 2022).**

Aims of the Study

This aim of this review about endodontic emergencies is to improve the management and prevention of acute endodontic problems, which can cause significant pain and discomfort for patients. By investigating the prevalence and causes of endodontic emergencies, researchers can develop effective treatment strategies that address the underlying causes of these problems. Furthermore, by evaluating the impact of endodontic emergencies on patient quality of life, researchers can highlight the importance of prompt and effective management of these conditions in order to improve patient outcomes.

Chapter One
Review of Literature

Chapter one
Review of Literature

1.1 What is an Endodontic Emergency?

An endodontic emergency can be defined as occurring When a patient has pain associated with inflammation of the pulp and/or periradicular tissues, or when there is pain (with or without swelling) caused by infection of the root canal system and/or the periradicular tissues. This description is somewhat broader than that proposed by **Wolcott et al. (2011)** and used by **Farmakis et al. (2016)**,

Where an endodontic emergency was defined as “pain And/or swelling caused by inflammation or infection of the pulp and/or periapical tissues”. However, their definition is limited since it does not include teeth that do not have pulps (e.g. a tooth with a pulpless infected root canal system; a tooth with a root canal filling, etc.), and it does not include all of the periradicular tissues (e.g. acute lateral periodontitis associated with a lateral canal or with a tooth that has external lateral inflammatory resorption) **(Abbott, 2022).**

Hence, the above broader description is proposed as it is more comprehensive and representative of all possible emergencies that may occur as a result of endodontically related conditions.There are many different causes of dental pain, but the Most common will be associated with dental caries, defective Restorations and trauma to a tooth **(Abbott, 2022).**

1.2 Differentiation of Emergency & Urgency

Whether a pretreatment, interappointment, or postobturation problem, it is important to differentiate between a true emergency and the less critical urgency. A true emergency is a condition requiring an unscheduled office visit with diagnosis and treatment now! The visit cannot be rescheduled because of the severity of the problem. Urgency indicates a less severe problem; a visit may be scheduled for mutual convenience of the patient and the dentist. Key questions (that may be asked by telephone) to determine severity include the following: **(Mahmoud Torabinejad et al., 2021)**

1. Does the problem disturb your sleeping, eating, working, concentrating, or other daily activities? (A true emergency disrupts the patient's activities or quality of life.)

2. How long has this problem been bothering you? (A true emergency has rarely been severe for more than a few hours to 2 days).

3. Have you taken any pain medication? Was the medication ineffective? (Analgesics do not relieve the pain of a true emergency.)

An affirmative answer to these questions requires an immediate office visit for management and constitutes a true emergency. Obviously, the patient's emotional and mental status must also be determined. To some patients, even a minor problem has major proportions and is disruptive **(Mahmoud Torabinejad et al., 2021).**

1.3 Treatment Planning

Inflammation and its consequences, that is, increased tissue pressure and release of chemical mediators in the pulp or peri-radicular tissues, are the major causes of painful dental emergencies. Therefore, reducing the irritant, or reduction of pressure or removal of the inflamed pulp or peri-radicular tissue should be the immediate goal; this usually results in pain relief. Of the two, pressure release is the most effective **(Torabinejad, 1994).**

Because pain is both a psychological and biologic entity, the management of acute dental pain must take into consideration both the physical symptoms and the emotional status of the patient. The patient's needs, fears, and coping mechanisms must be compassionately understood. This assessment and the clinician's ability to build rapport with the patient are critical factors **(Bender, 2000).**

Once it has been determined that endodontic treatment is necessary, it is incumbent on the clinician to take the proper steps necessary to manage the acute dental emergency. The clinician has a responsibility to inform the patient of the recommended treatment plan and to advise the patient of the treatment alternatives, the risks, and benefits that pertain, and the expected prognosis under the present circumstances. Given this information, the patient may elect extraction over endodontics or possibly request a second opinion. The treatment plan should never be forced on a patient. The informed course of treatment is made jointly between the patient and the clinician **(Gatchel, 1992).**

In the event of an endodontic emergency, the clinician must determine the optimal mode of treatment according to the diagnosis. Treatment may vary depending on the pulpal or periapical status, the intensity and duration of pain, and whether there is diffuse or fluctuant swelling **(Holmes-Johnson et al., 1986).**

1.4 Patient Management

Patient anxiety is an important factor in achieving a satisfactory endodontic outcome, especially at an emergency visit.

More than 200 studies indicate that preemptive behavioral intervention to reduce anxiety before and after surgery reduces postoperative pain intensity and intake of analgesics and accelerates recovery **(Carr, 1999).** A clinical study determined that the higher the level of anxiety, as measured by a visual analogue anxiety scale, the less likely it was that pain would be eliminated after administration of a local anesthetics. A conversation with the patient prior to treatment, in which the clinician discusses the pain-preventive strategy, including the use of profound local anesthesia, is an important element of the therapeutic approach **(DiBernardi et al., 2009).**

1.5 Profound Anesthesia

Achieving profound local anesthesia for teeth with irreversible pulpitis is challenging and critical. Maxillary anesthesia is usually achieved by the use of infiltration or block anesthesia in the buccal and palatal areas. If profound anesthesia is defined as achieving the complete absence of pain, a single injection for a mandibular molar is usually insufficient **(Reader et al, 2011).**

Intraosseous, ligamental, and intrapulpal injections are valuable supplementary injections that can help achieve this goal. It is important to note that a numb lip is not adequate proof of complete local anesthesia. The clinician is advised to recheck the chief complaint prior to initiating treatment. Absence of the chief complaint, whether it is thermal sensitivity or pain on percussion, is the best means of determining profound anesthesia **(Reader et al. 2011).**

1.6 Categories of Endodontic Emergencies:

Endodontic emergencies have been classified in several ways by various authors, but a common system has been to consider endodontic emergencies in relation to the timing of root canal treatment **(Carrotte, 2004),** such as:

1. Endodontic emergencies that occur prior to endodontic treatment—this applies to teeth that have not had any previous endodontic treatment;**(Abbott, 2022).**

2. Endodontic emergencies that occur during endodontic treatment (usually root canal treatment or root canal retreatment)—this applies to teeth undergoing treatment over more than one appointment; these emergencies are often referred to as a "flare-up" **(Azim et al., 2017);** and

3. Endodontic emergencies that occur after endodontic treatment—this applies either to post-operative pain following the root canal filling stage of treatment or to teeth that have had previous root canal treatment at some time in the past and have become infected again which has led o acute apical periodontitis or an acute apical abscess **(Abbott, 2022).**

1.6.1 Pre-treatment Emergencies:

These are situations in which the patient is seen initially with severe pain and/or swelling. Problems occur with both diagnosis and treatment. These emergencies require a diagnosis and treatment sequencing. Each step is important: **(Mahmoud Torabinejad et al., 2021)**

1. Categorizing the problem,
2. Taking a medical history,
3. Identifying the source,

4. Making the diagnosis,
5. Planning the treatment,
6. Treating the patient.

Usually, such emergencies are accompanied by a high level of patient anxiety, which can further complicate diagnosis and treatment.Teeth that cause pretreatment emergencies may be associated with irreversible pulpitis and/or symptomatic periodontitis or pulp necrosis with or without apical pathosis and swelling. Swelling may be localized or diffused. Each of these situations requires a somewhat different clinical approach based on biologic considerations **(Torabinejad and Walton, 1991).**

1.6.1.a Teeth with vital pulps can have one of the following presentations: **(Louis and Kenneth, 2021)**

- **Normal:** The teeth are asymptomatic with no objective pathoses.
- **Reversible pulpitis:** There is a reversible sensitivity to cold or osmotic changes (i.e., sweet, salty, and sour).
- **Irreversible pulpitis:** The sensitivity to temperature changes is more intense and with a longer duration.
- **Reversible pulpitis**

Reversible pulpitis can be induced by caries, exposed dentin, recent dental treatment, and defective restorations. Conservative removal of caries, protection of dentin, and a proper restoration will typically resolve the symptoms. However, the symptoms from exposed dentin, specifically from gingival recession and cervically exposed roots, can often be difficult to alleviate. Topical applications of desensitizing agents and the use of certain dentifrices have been helpful in the management of dentin hypersensitivity **(Louis and Kenneth, 2021)**.

- **Irreversible pulpitis**

Irreversible pulpitis is often the result of inflammation of the pulp due to a microbial insult from caries or microleakage associated with a defective restoration. Exacerbation of a tooth with irreversible pulpitis is characterized by pain, which may be severe. The pain may occur with or without provocation and tends to increase in severity. A pulp with irreversible pulpitis is usually free of bacterial colonization in the root canal. Infection is most often confined to the coronal site of the pulp that is exposed to the oral cavity. As long as the radicular pulp remains vital, it usually protects itself against microbial invasion and colonization **(Siqueira, 2005) .**

It has been demonstrated that removal of the pulp from the pulp chamber (pulpotomy) is a highly predictable approach to alleviating pain at an emergency visit **(Hasselgren and Reit, 1989).**

Since the early 1980s, there seems to have been an increase in the acceptability of providing endodontic therapy in one visit, especially in cases of vital pulps, with most studies revealing an equal number, or fewer, flareups after single-visit endodontic treatment **(Eleazer and Eleazer, 1998;Oliet, 1998).**

However, this has not come without controversy, with some studies showing otherwise, contending that there is more posttreatment pain after single-visit endodontics, and possibly a lower long-term success rate **(Weiger et al., 1998).** Unfortunately, time constraints at the emergency visit often make the single-visit treatment option not practical **(Ashkenaz, 1984).**

If root canal therapy is completed at a later date, medicating the canal with calcium hydroxide has been suggested to reduce the chances of bacterial growth in the canal between appointments in most studies **(Chong and Pitt Ford, 1992).**

One randomized clinical study showed that a dry cotton pellet was as effective in relieving pain as a pellet moistened with camphorated monochlorophenol (CMCP), metacresylacetate (cresatin), eugenol, or saline **(Hasselgren and Reit, 1989).** Sources of infection, such as caries and defective restorations, should be completely removed to prevent recontamination of the root canal system between appointments **(Hasselgren and Reit, 1989).**

For emergency management of vital teeth that are not initially sensitive to percussion, occlusal reduction has not been shown to be beneficial **(Gatewood et al., 1990).**

However, the clinician should be cognizant of the possibility of occlusal interferences and prematurities that might cause tooth fracture under heavy mastication. In vital teeth in which the inflammation has extended periapically, which will present with pretreatment pain to percussion, occlusal reduction has been reported to reduce posttreatment pain **(Gatewood et al., 1990;Nusstein et al,. 1998;Rosenberg et al,. 1998).**

Antibiotics are not recommended for the emergency management of irreversible pulpitis **(Keenan et al, 2006;Sutherland and Matthews, 2003)** as placebo-controlled clinical trials have demonstrated that antibiotics have no effect on pain levels in patients with irreversible pulpitis **(Nagle et al., 2000).**

Most endodontists and endodontic textbooks recommend the emergency management of symptomatic irreversible pulpitis to involve the initiation of root canal treatment,**(Chong and Pitt Ford, 1992;Hasselgren, 2000;Lee et al, 2009;Torabinejad and Walton, 2009),** with complete pulp removal and total debridement of the root canal system. Unfortunately, in an emergency situation, the allotted time necessary for this treatment is often an issue. Given the potential time

constraints and inevitable differences in skill level between clinicians, it may not be feasible to complete the total canal cleaning at the initial emergency visit. Subsequently, especially with multirooted teeth, a pulpotomy (removal of the coronal pulp) has been advocated for emergency treatment of irreversible pulpitis **(Carrotte ,2004;Hasselgren, 2000).**

1.6.1.b Necrotic teeth with symptomatic apical periodontitis

Over the years, the proper methodology for the emergency endodontic management of necrotic teeth has been controversial. In a 1977 survey of board-certified endodontists, it was reported that, in the absence of swelling, most respondents would completely instrument the canals, keeping the file short of the radiographic apex. However, when swelling was present, the majority of those polled in 1977 preferred to leave the tooth open, with instrumentation extending beyond the apex to help facilitate drainage through the canals **(Dorn SO et al., 1977).**

Years later and again validated in a 2009 study, most respondents Favored complete instrumentation regardless of the presence of swelling. Also, it was the decision of 25.2% to 38.5% of the clinicians to leave these Teeth open in the event of diffuse swelling; 17.5% to 31.5% left the teeth Open in the presence of a fluctuant swelling. However, as discussed later, There is currently a trend toward not leaving teeth open for drainage. There is Also another trend: when treatment is done in more than one visit, most Endodontists will use calcium hydroxide as an intracanal medicament **(Lee et al., 2009).**

Care should be taken not to push necrotic debris beyond the apex during root canal instrumentation, as this has been shown to promote more posttreatment

discomfort **(Gatewood et al., 1990;Reddy and Hicks, 1998;Siqueira and Rocas, 2003).**

Crown-down instrumentation techniques have been shown to remove most of the debris coronally rather than pushing it out the apex. The use of positive-pressure irrigation methods, such as needle-and-syringe irrigation, also poses a risk of expressing debris or solution out of the apex **(Boutsioukis et al, 2014;Desi and Himel, 2009).**

Improvements in technology, such as electronic apex locators and use of the limited cone-beam computed tomography (CBCT) have facilitated increased accuracy in determining working length measurements **(Metka et al., 2014).**

Moreover, new negative-pressure irrigation systems may allow for a more thorough canal debridement with less apical extrusion of debris **(Charara et al., 2016;Mitchell et al., 2010).**

An outcome study indicated that the use of a negative apical pressure irrigation device significantly reduces the postoperative pain levels in comparison to conventional needle irrigation **(American Association of Endodontics, 2003).**

A randomized clinical trial demonstrated final irrigation with 20 mL sterile cold (2.5°C) saline solution delivered to the working length with a sterile, cold (2.5°C) EndoVac microcannula (Kerr Endo, Orange Country, CA) for 5 minutes. They concluded that cryotherapy reduced the incidence of postoperative pain and the need for medication in patients presenting with a diagnosis of necrotic pulp and symptomatic apical periodontitis **(Vera et al., 2018).**

- **Trephination**

In the absence of swelling, trephination is the surgical perforation of the alveolar cortical plate to release, from between the cortical plates, the accumulated inflammatory and infective tissue exudate that causes pain. Its use has been historically advocated to provide pain relief in patients with severe and recalcitrant periradicular pain **(Dorn et al., 1977).**

The technique involves an engine-driven perforator entering through the cortical bone and into the cancellous bone, often without the need for an incision, in order to provide a pathway for drainage from the periradicular tissues**(as we see in fig 1.1)**,**(Chestner et al., 1986).**

Although more recent studies have failed to show the benefit of trephination in patients with irreversible pulpitis with symptomatic apical periodontitis **(Moos et al., 1996)** or necrotic teeth with symptomatic apical periodontitis, **(Nusstein et al .,1998).** there remain some advocates who recommend trephination for managing acute and intractable periapical pain **(Henry and Fraser, 2003).**

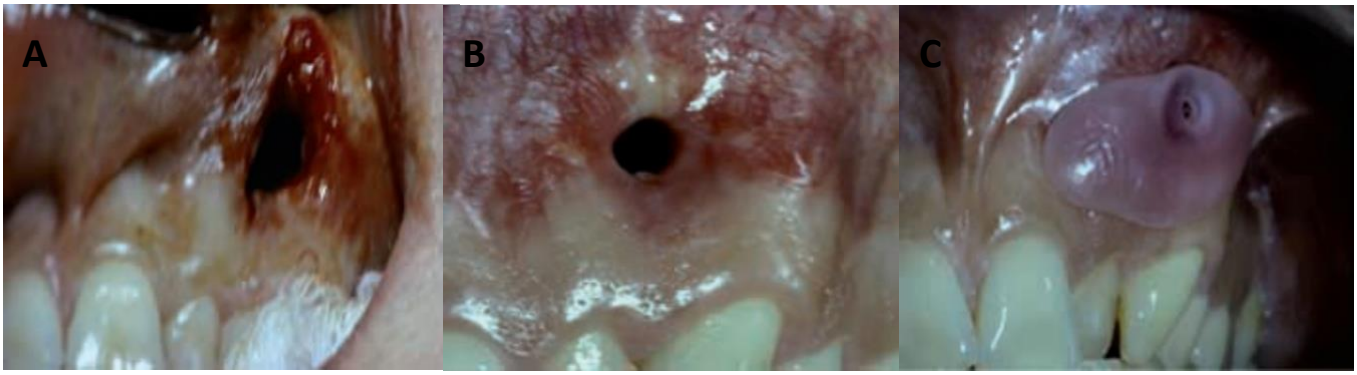

Fig.1.1 **Trephination. A,** Surgical window into cyst. **B,** Healed surgical window. **C**, Acrylic stint in place for decompression. **(Courtesy Dr. Craig).**

The clinician should understand that local anesthesia may be difficult for cases with acute inflammation or infection. Extreme care must be taken when carrying out a trephination procedure to guard against inadvertent and possibly irreversible injury to the tooth root or surrounding structures, such as the mental foramen, intra-alveolar nerve, or maxillary sinus **(Horrobin et al., 1997).**

- **Necrosis and single-visit endodontics**

Although single-visit endodontic treatment for teeth diagnosed with irreversible pulpitis is not contraindicated, **(Albahaireh and Alnegrish, 1998;Peters and Wesselink, 2005;Weiger et al., 2000),** performing single-visit endodontics on necrotic and previously treated teeth is not without controversy. In cases of necrotic teeth, although research has indicated that there may be no difference in posttreatment pain if the canals are filled at the time of the emergency versus a later date, **(Eleazer and Eleazer, 1998)** some studies 105,112 have questioned the long-term prognosis of such treatment, especially in cases of symptomatic apical periodontitis **(Sjogren et al., 1997).** Several studies, **(Field et al., 2004;Kvist et al 2004)** including a CONSORT (Consolidated Standards of Reporting Trials) meta-analysis, have shown no difference in outcome between single-visit and two-visit treatments **(Penesis et al., 2008).**

1.6.1.c Pulpal necrosis with acute apical abscess

Tissue swelling may be associated with an acute apical abscess at the time of the initial emergency visit, or it may occur as an inter-appointment flare-up or as a postendodontic complication. Swellings may be localized or diffuse, fluctuant or firm. Localized swellings are confined within the oral cavity, whereas a diffuse swelling, or cellulitis, is more extensive, spreading through adjacent soft tissues and dissecting tissue spaces along fascial planes **(Sandor et al., 1998).**

Swelling may be controlled by establishing drainage through the root canal or by incising the fluctuant swelling. Antibiotics may be recruited when there are systemic manifestations of the infection, such as fever and malaise. The principal modality for managing swelling secondary to endodontic infections is to achieve drainage and remove the source of the infection **(Harrington and Natkin, 1992).**

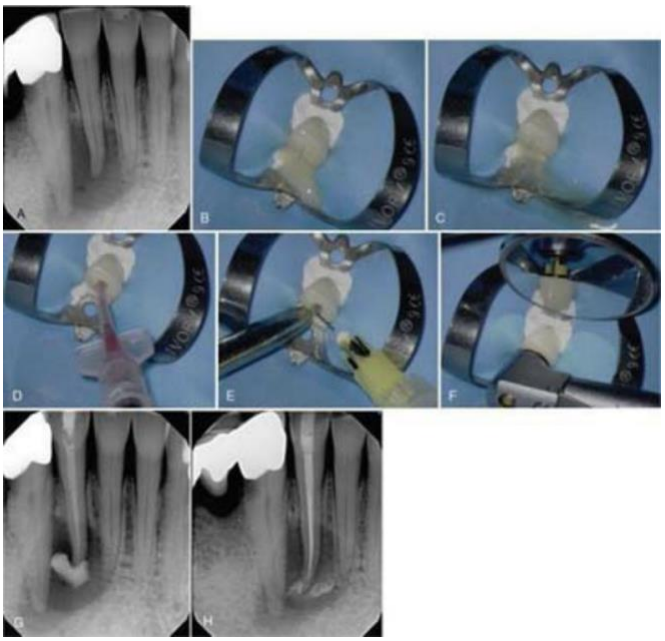

Fig.1.2 Drainage of pus through the root canal. A, Acute apical Abscess arising from the lower right lateral incisor with radiographic Radiolucency. **B**, Initial drainage through the canal. **C**, Persistent Drainage through the canal. **D**, Aspiration of the content with a plastic Suction tip. **E**, Irrigation with NaOCl. **F**, Mechanical debridement. **G**, Placement of calcium hydroxide. **H**, Obturation of root canals during second visit.**(Pathways of the pulp 12th edition).**

When the swelling is localized, the preferred avenue is drainage through the root canal **(see Fig 1.2).** Complete canal debridement and disinfection **(Turkun and Cengiz, 1997)** are paramount for success regardless of observable drainage, because the presence of any bacteria remaining within the root canal system will compromise the resolution of the acute infection **(Matusow and Goodall, 1983).**

In the presence of persistent swelling, gentle finger pressure to the mucosa overlying the swelling may help facilitate drainage through the canal. Once the canals have been cleaned and allowed to dry, calcium hydroxide as the intracanal medicament **(Lee et al., 2009)** should be placed and the access properly sealed **(Chong and Pitt Ford, 1992;Gatewood et al., 1990;Hasselgren, 2000).**

1.6.2 Inter-appointment Emergencies

The interappointment flare-up is a true emergency that occurs after an endodontic appointment and is so severe that an unscheduled patient visit and treatment are required. Despite judicious and careful treatment procedures, complications such as pain, swelling, or both may occur. Regional temporary paresthesia has even been reported. As with emergencies occurring before root canal therapy, these flare-ups are undesirable and disruptive events and must be resolved quickly. Occasionally flare-ups are unexpected, although they can often be better predicted according to certain patient presenting factors **(Nyerere et al., 2006).**

1.6.2.a Causative Factors

Assessing causality is difficult when reviewing the literature on flareups; however, certain risk factors have emerged. These factors generally can be categorized as related to the patient (including pulpal or periapical diagnosis). Treatment procedures are unrelated to flareups, although this is a popular belief. Patient factors include gender (more flare-ups are reported to occur in females, although this circumstance may represent a greater tendency for females to seek medical care for painful symptoms) **(Dao and LeResche, 2000)** and preoperative diagnosis. Flare-ups are uncommon in teeth with vital pulps **(Walton and Fouad, 1992;Sim, 1997).**

More often, flare-ups occur in teeth with necrotic pulps, and especially in those with a periapical diagnosis of symptomatic periapical periodontitis or acute apical abscess **(Walton and Fouad, 1992;Sim, 1997;Imura and Zuolo, 1995).** The presence of a periapical radiolucency has also been shown to be a risk factor **(Walton and Fouad, 1992;Imura and Zuolo, 1995),** Clearly, the patient who experiences a flare-up is more likely to have presented with significant preoperative pain and/or swelling **(Trope, 1991).**

Treatment factors have also been examined for the potential to cause flare-ups. Although it would seem intuitive that flare-ups would be related to certain procedures, such as overinstrumentation, pushing debris beyond the apex, or completing the endodontic therapy in one visit, no definitive treatment risk factors have been identified **(Genet et al., 1987).**

1.6.2.b Prevention

- **Procedures**

Use of long-acting anesthetic solutions, complete cleaning and shaping of the root canal system (possibly), analgesics, and psychological preparation of patients (particularly those with preoperative pain) will decrease interappointment symptoms in the mild to moderate levels. There are, however, no demonstrated treatment or therapeutic measures that will reduce the number of interappointment flare-ups. In other words, no particular relationship has been shown between flare-ups and specific treatment procedures **(Torabinejad et al., 1994).**

- **Therapeutic Prophylaxis**

A popular preventive approach has been the prescribing of antibiotics to minimize postoperative symptoms. This practice has been demonstrate to be not useful and needlessly exposes the patient to expensive, potentially dangerous drugs,

as described previously **(Eleazer and Eleazer, 1998;Walton and Chiappinelli, 1993;Pickenpaugh et al., 2001).**

In contrast, certain NSAIDs have been shown to reduce postendodontic treatment pain. For patients at risk for a flare-up, 400-600 mg of ibuprofen should be given while the patient is in the chair, and then taken by the clock for the first 24 to 48 hours postoperatively. Although this medication will reduce postoperative symptoms, it is uncertain whether it will reduce the incidence of flare-ups **(Menke et al., 2000;Gopikrishna and Parameswaran, 2003).**

1.6.2.c Treatment of Flare-Ups

Reassurance (the "Big R") is the most important aspect of treatment. The patient is generally frightened and upset and may even assume that extraction is necessary. The explanation is that the flare-up is neither unusual nor irrevocable and will be managed. Next in importance are restoring the patient's comfort and breaking the pain cycle. For extended anesthesia and analgesia, administration of bupivacaine hydrochloride is recommended **(Gordon et al., 1997).**

- **Previously Vital Pulps with Complete Debridement**

If complete removal of the inflamed vital pulp tissues was accomplished at the first visit, this situation is unlikely to be a true flare-up, and patient reassurance and the prescription of a mild to moderate analgesic (9.5) often will suffice. Generally, nothing is to be gained by opening these teeth; the pain will usually regress spontaneously, but it is important to check that the temporary restoration is not in traumatic occlusion. Placing corticosteroids in the canal or administering an intraoral or intramuscular injection of these medications after cleaning and shaping reduces inflammation and somewhat lowers the level of moderate pain. Flareups,

however, have not been shown to be prevented by steroids, whether administered intracanal or systemically **(Calderon, 1993;Liesinger et al., 1993).**

- **Previously Vital Pulps with Incomplete Debridement**

In previously vital pulps with incomplete debridement, it is likely that tissue remnants have become inflamed and have become a major irritant. The working length should be rechecked, and the canal(s) should be carefully cleaned with copious irrigation with NaOCl. A dry cotton pellet is then placed, followed by a temporary restoration, and a mild to moderate analgesic is prescribed. Occasionally, a previously vital pulp (with or without complete debridement) will develop into an acute apical abscess. This problem will occur sometime after the appointment and indicates that pulpal remnants have become necrotic and are invaded by bacteria **(Trope, 1990).**

- **Previously Necrotic Pulps with No Swelling**

Occasionally teeth with previously necrotic pulps but no swelling develop an acute apical abscess (flare-up) after the appointment. The abscess is confined to bone and can be very painful. The tooth is opened, and the canal is gently recleaned and irrigated with NaOCl. Drainage should be established if possible **(see Fig.1.3).** If there is active drainage from the tooth after opening, the canal should be recleaned (or debridement completed) and irrigated with NaOCl **(Campanelli et al., 2008).** The rubber dam is left in place after the tooth is opened; the patient is allowed to rest pain-free for at least 30 minutes or until drainage stops. Then, the canals are dried, Ca(OH)2 paste is placed, and the access is sealed. The tooth should not be left open, If there is no drainage, the tooth should also be lightly instrumented and gently irrigated, medicated with Ca(OH)2 paste, and then closed. The symptoms usually subside but do so more slowly than if drainage were present.

Again, patient education and reassurance are critical. A long-acting anesthetic and an analgesic regimen for moderate to severe pain are helpful; antibiotics are not indicated **(Fouad et al., 1996;Henry et al., 2001).**

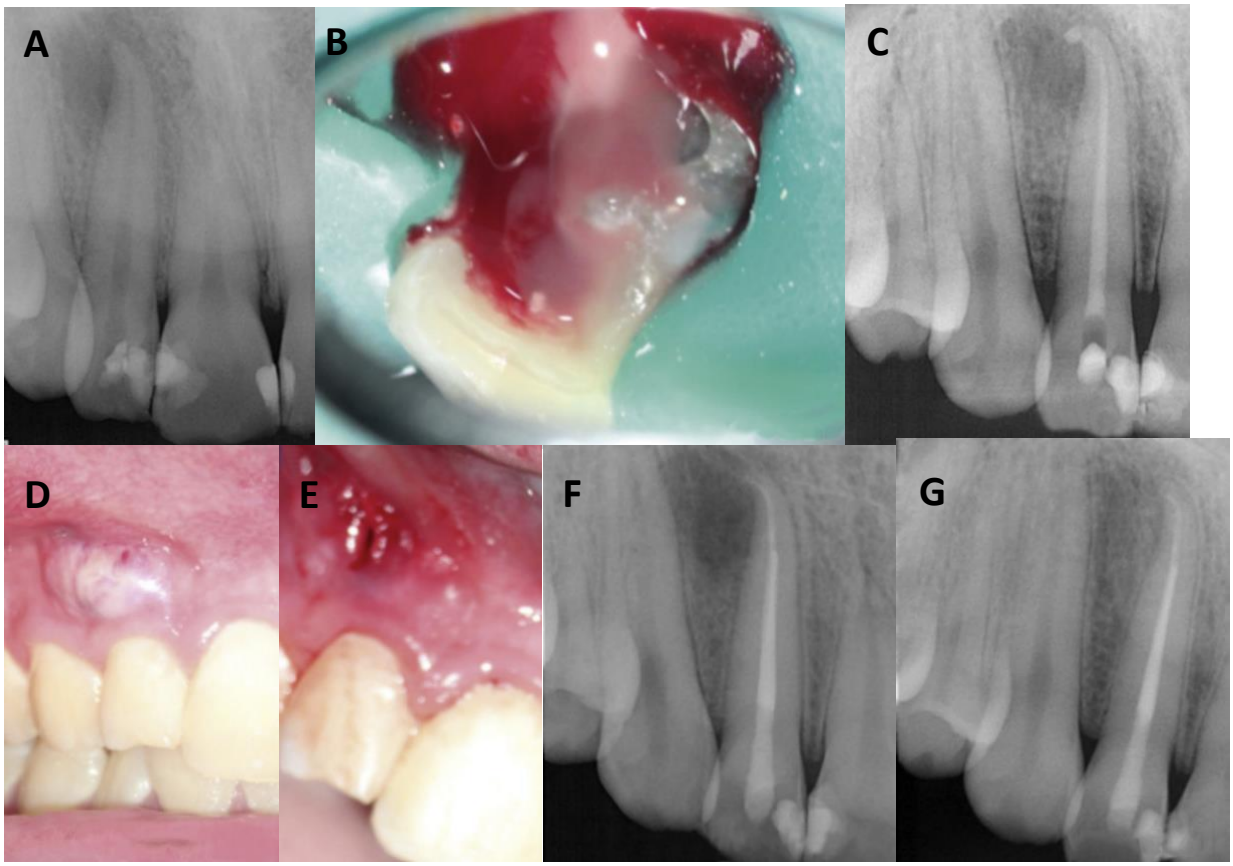

Fig.1.3 Management of pulp necrosis with acute apical abscess with localized intraoral swelling for a 60-year-old female patient with pain at 5/5 on visual analog scale (VAS). **A,** Preoperative radiograph of #7. **B,** Drainage through tooth upon access. **C,** Radiograph of #7 with calcium hydroxide [Ca(OH)2]. **D,** Preoperative photograph of intraoral swelling. **E,** Photograph post–incision and drainage. **F,** Postoperative Radiograph of completed obturation and access restoration at second visit. **G,** Postoperative radiograph at 2 years post treatment. **(Courtesy Dr. Obadah Ayatah, UTHSCSA, San Antonio**

- **Previously Necrotic Pulps with Swelling**

These cases are best managed with I&D **(see Fig. 1.4).** In addition, it is most important that the canals have been debrided. If not, they should be opened and débrided, medicated with Ca(OH)2 paste, and sealed. Then I&D with placement of a drain (if there is continuous drainage) are completed. Occasionally, but rarely, a flare-up or a presenting acute apical abscess may be serious or even life-threatening **(see Fig. 1.5).** These situations may require hospitalization and aggressive therapy with the cooperation of an oral surgeon **(Beus et al., 2018).**

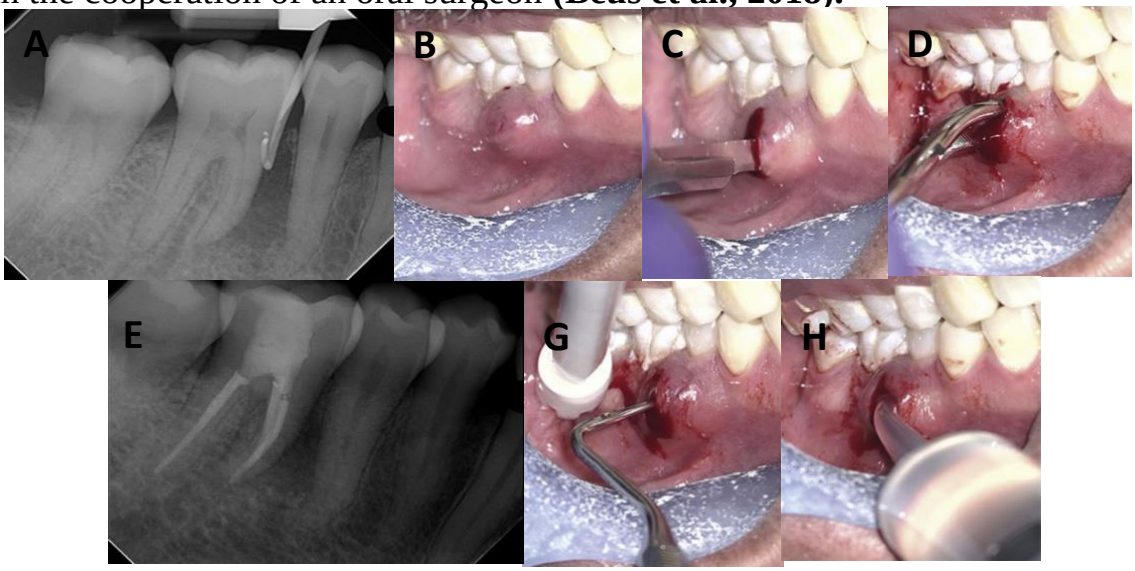

Fig. 1.4 Management of pulp necrosis with acute apical abscess with localized intraoral swelling for a 60-year-old female patient with pain at 5/5 on visual analog scale (VAS). **A,** Preoperative radiograph of #30 with sulcular sinus tract. **B,** Preoperative photograph of intraoral swelling. **C,** Photograph of incision. **D,** Blunt dissection. **E,** Postoperative radiograph of completed obturation and access restoration at second visit. **F,** Curettage. G, Sterile saline irrigation. **(Courtesy Dr. Saeed Bayat, UTHSCSA, San Antonio, TX, USA.)**

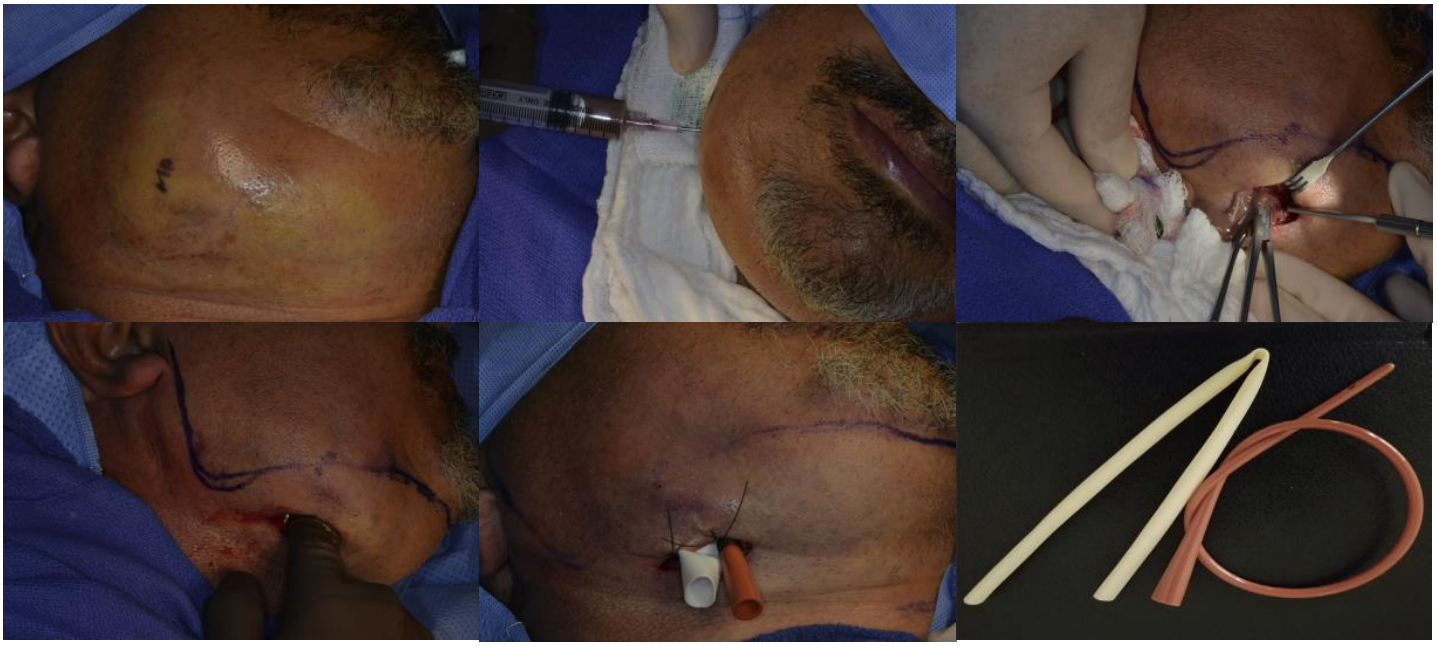

Fig. 1.5 Management of pulp necrosis with acute apical abscess with diffused extraoral swelling for a 43-year-old male patient hospitalized for aggressive therapy with nasal intubation. Pain at 5/5 on visual Analog scale (VAS). **A,** Preoperative photograph of extraoral swelling. **B,** Photograph of syringe aspiration. **C and D,** Drainage. **E,** Postoperative photograph of two drains placed and sutured. **F,** Types of extraoral Drains: Covidien Dover Rob-Nel Urethral Catheter and Penrose drain. **(Courtesy Dr. Daniel Perez, UTHSCSA, San Antonio, TX, USA.)**

1.6.3 Postobturation Emergencies

True emergencies (flare-ups) postobturation are infrequent, although pain at the mild level is common. Therefore active intervention is seldom necessary; usually symptoms will resolve spontaneously. It has been demonstrated histologically that the most favorable response of periapical tissues occurred when both instrumentationmand filling were short of the apical constriction **(Ricucci and Langeland, 1998).**

A clinical study found that the best treatment outcome in infected teeth with periradicular lesions occurred when the apical terminus of the filling was 0 to 2 mm short of the radiographic apex.The same study determined that the prognosis was less favorable with significant underfill or overfill **(Sjogren et al., 1990).**

1.6.3.a Causative Factors

Little is known about the etiologic factors involved in postoperative pain after obturation. Reports of the incidence of postobturation pain vary; however, most reports show that the pain tends to occur in the first 24 hours **(Torabinejad et al., 1994).**

A correlation has been found between the level of obturation and pain incidence, with overextension associated with the highest incidence of discomfort **(Torabinejad et al., 1994).**

Postobturation pain also relates to preobturation pain; levels of pain reported after obturation tend to correlate to levels of pain before the appointment **(Gesiet al., 2006).**

1.6.3.b Treatment

Information about possible discomfort for the first few days (especially in patients who had higher levels of preoperative pain), reassurance about the availability of emergency services, and administration of analgesics for mild pain **(see Fig.6)** significantly control the patient's anxiety and prevent overreaction. This support, in turn, decreases the incidence of postobturation frantic telephone calls or "emergency" visits. Some patients, however, do develop serious complications and require follow-up treatment. Retreatment is indicated when prior treatment obviously has been inadequate. Apical surgery is often required when an acute apical abscess develops, and there is uncorrectable, inadequate root canal treatment. If root canal treatment was acceptable, I&D of swelling after obturation (an occasional occurrence) should be performed; usually the swelling resolves without further treatment. At times, the patient reports severe pain, but there is no evidence of acute apical abscess, and the root canal treatment has been well done. These patients are treated with reassurance and appropriate analgesics **(see Fig. 1.6);** again, the symptoms usually subside spontaneously. Patients with postobturation emergencies that do not respond to therapy should be referred to an endodontist for other treatment modalities, such as surgery **(Torabinejad and Walton, 1991).**

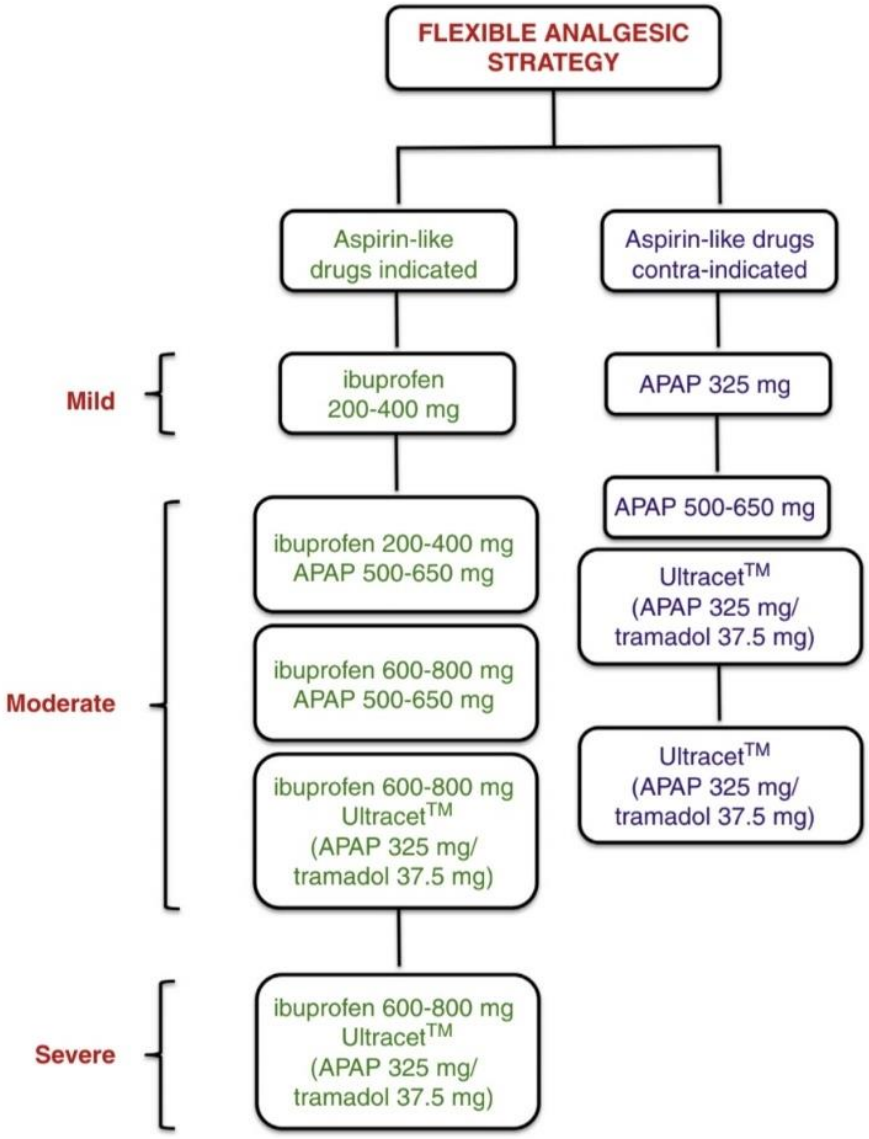

Fig. 1.6 Simplified analgesic strategy to guide drug selection based on patient history and level of present Or anticipated posttreatment pain **(Endo principles).**

1.7 Drainage

Drainage of pus from an abscess can speed recovery **(see Fig. 1.7 and 1.8).** The removal of dead lymphocytes and a preponderance of dead bacteria from the center of an infection can bring rapid resolution of symptoms and head off worsening of the infection. Return of local vascular flow aids the process of reaching and maintaining antibiotic levels and also reduces local tissue acidity, enhancing the action of local anesthetics. Chronic drainage by way of a sinus tract sharply reduces the occurrence of flare-up because of drainage. Surgical drainage can be quite helpful in treating infections. An in-dwelling drain to prevent premature closure of the epithelium is indicated in many situations **(see Fig. 1.9).** Foreign bodies and larger amounts of necrotic tissue may call for surgical removal **(Marshall and al Naqqbi, 2009).**

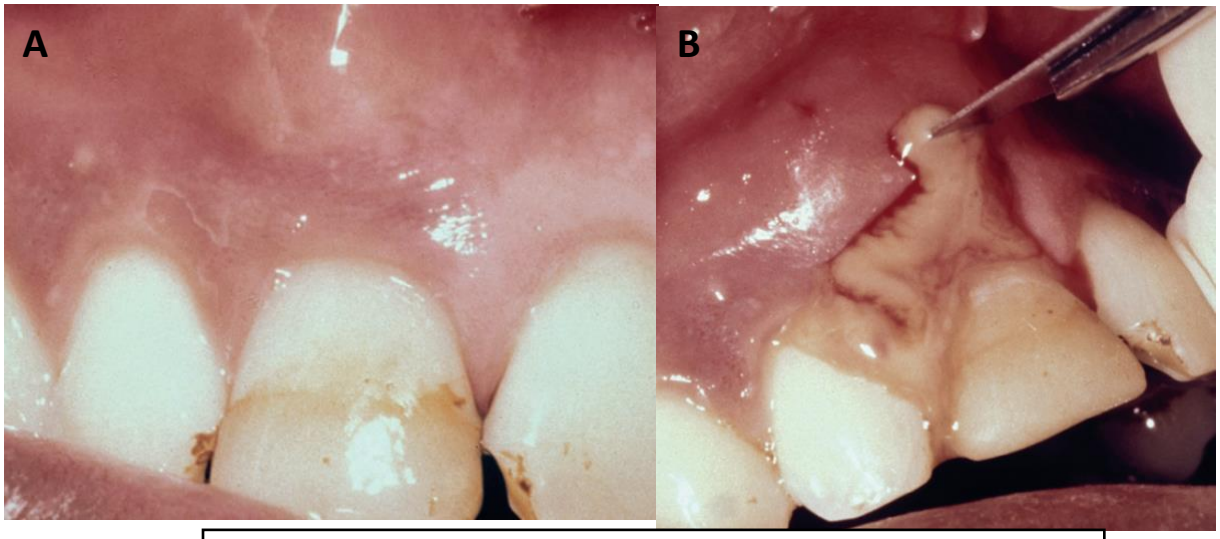

Fig. 1.7 **Drainage. A,** Localized swelling. **B,** Incision for drainage after Cleaning and shaping of the offending incisor. **(Courtesy Dr. E.Rivera.)**

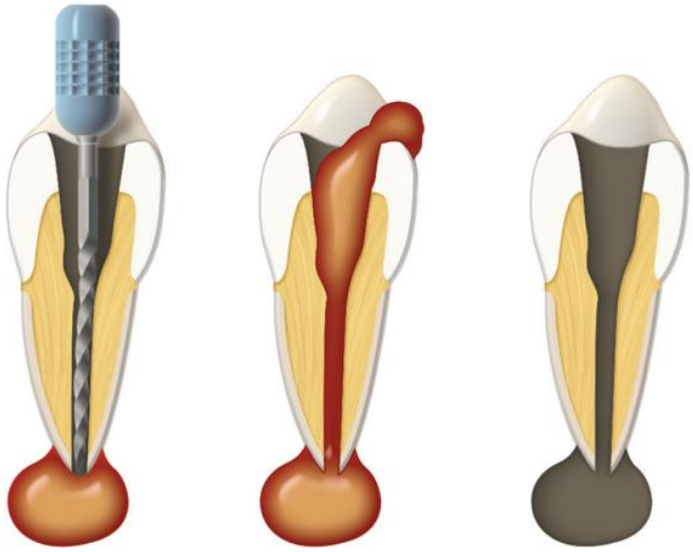

Fig. 1.8 After opening into the root canal and establishment of drainage, instrumentation should be confined to the root canal system. Release of purulence removes a potent irritant (pus) and relieves pressure **(Endodontics Principles and**

Mohammadi and Abbott advocate use of this approach to prevent the tissue damage characteristic of disinfectants inadvertently introduced into the periapex **(Mohammadi and Abbott, 2009).**

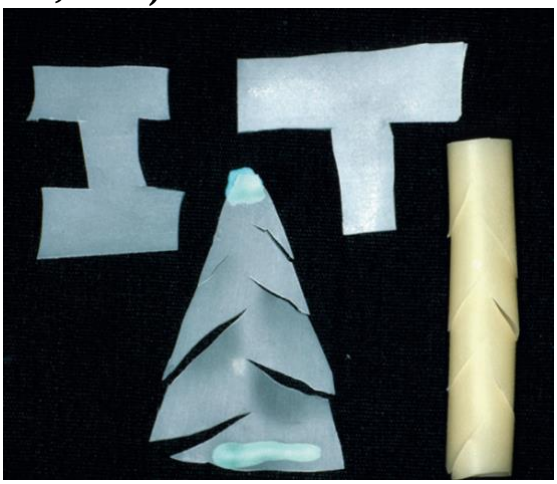

Fig. 1.9 Types of rubber drains. Left to right, I drain, Christmas tree drain, T drain, and Penrose drain with oblique cuts. These drains are self-retentive and do not require suturing to the incision margins **(Endodontics Principles and Practice)**

1.8 Leaving teeth open

On rare occasions, canal drainage may continue from the periapical spaces **(See Fig. 1.10).** In these cases, the clinician may opt to step away from the patient for some time to allow the drainage to continue and hopefully resolve on the same treatment visit **(Torabinejad and Walton, 2009).**

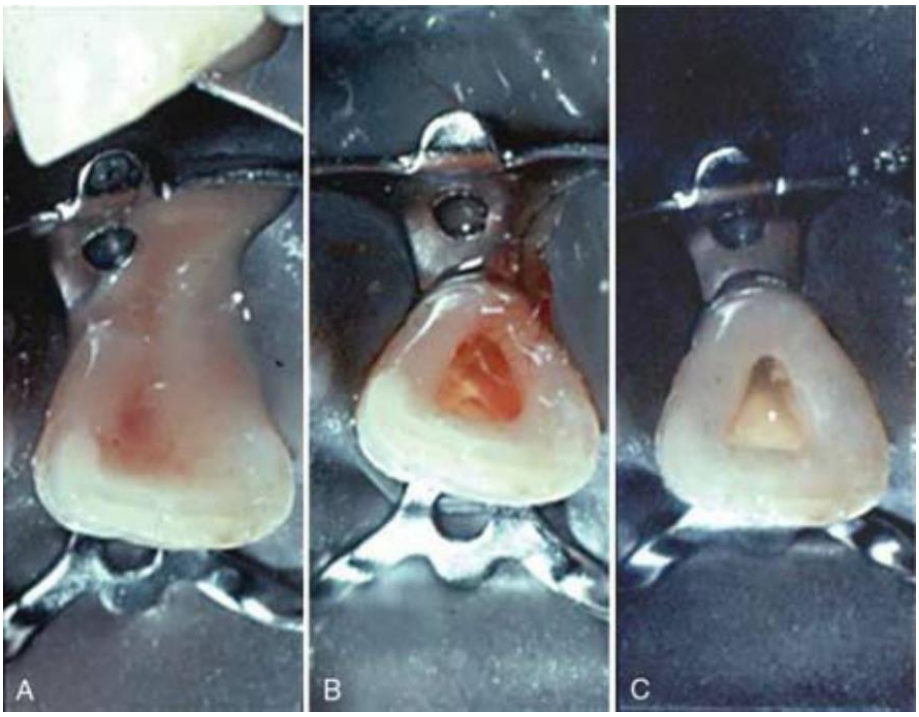

Fig. 1.10 Nonvital infected tooth with active drainage from the Periapical area through the canal. A, Access opened and draining for 1 Minute. **B,** Drainage after 2 minutes. **C,** Canal space dried after 3 Minutes **(Pathways of the pulp 12th edition)**

Historically, in the presence of acutely painful necrotic teeth with no swelling or diffuse swelling, 19.4% to 71.2% of surveyed endodontists would leave the tooth open between visits **(Dorn et al., 1977;Dorn et al., 1977).**

However, the more current literature makes it clear that this form of treatment would impair uneventful resolution and create a more complicated procedure **(Auslander, 1970;Bence et al., 2000;Weine et al., 1975).**

For this reason, leaving teeth open between appointments is not recommended. Foreign objects have been found in teeth left open for drainage **(see Fig. 1.11).** There has even been a documented case report of a foreign object being found to enter the periapical tissues through a tooth that had been left open for drainage. In addition, leaving a tooth open provides an opportunity for oral microorganisms to invade and colonize the root canal system if the tooth is left open for an extended period **(Simon et al., 1982).**

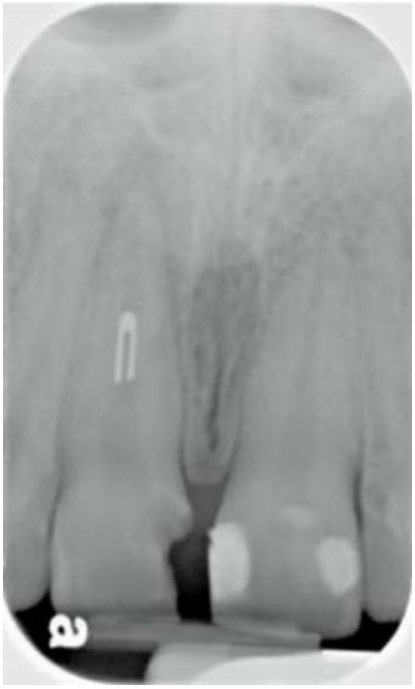

Fig. 1.11 Foreign object in tooth left open to drain. Patient used a Sewing needle to clear out food particles that were blocking the canal and broke the needle in the tooth **(Pathways of the pulp 12th edition)**

1.9 Cracked and fractured teeth

Cracks and incomplete fractures can be challenging to locate and diagnose, but their detection can be an essential component in the management of an acute dental emergency. In the early stages, cracks are small and difficult to discern. Removal of filling materials, applications of dye solutions, selective loading of cusps, transillumination, and magnification are helpful in their detection **(see Fig. 1.12).** As the crack or fracture becomes more extensive, it can become easier to visualize. Because cracks are difficult to find and their symptoms can be so variable, the name cracked tooth syndrome has been suggested, even though it is not indeed a syndrome **(Cameron, 1976).**

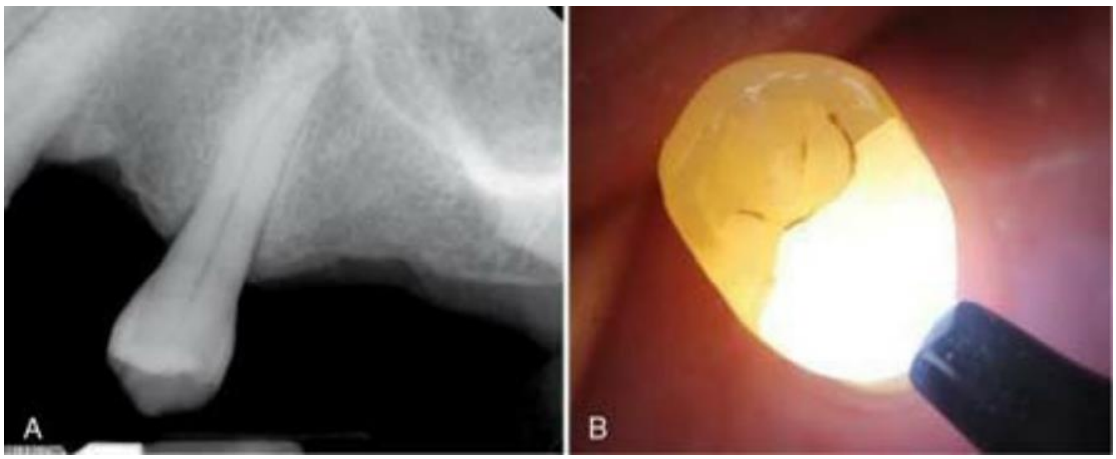

Fig. 1.12 Cracked teeth detection. A, Preoperative radiograph. **B,** Transillumination **(Pathways of the pulp 12th edition)**

Cracks in vital teeth often exhibit a sudden and sharp pain, especially during mastication. Cracks in nonvital or obturated teeth tend to have more of a “dull ache” but can still be sensitive to mastication **(Cameron, 1976).**

The determination of the presence of a crack or fracture is paramount because the prognosis for the tooth may be directly dependent on the extent of the crack or the longitudinal fracture. Management of cracks in vital teeth may be as simple as a bonded restoration or a full coverage crown. However, even the best efforts to manage a crack may be unsuccessful, often requiring endodontic treatment or extraction. Fractures in nonvital or obturated teeth may be more challenging. In addition, it must be determined whether the crack or fracture was the cause of pulpal necrosis and whether there has been an extensive periodontal breakdown. If so, the prognosis for the tooth is generally poor; thus, extraction is recommended **(see Fig. 1.13), (Cameron, 1976).**

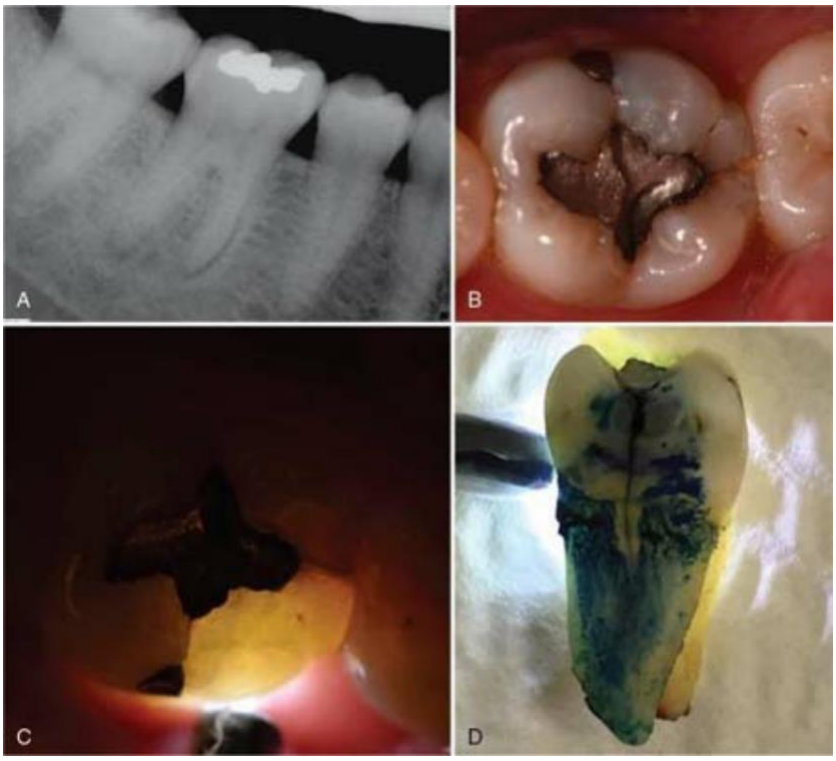

Fig. 1.13 Checking the prognosis of the tooth. A, Preoperative radiograph. **B,** Clinical view. **C,** Transillumination. **D,** Extracted tooth showing the extension of them Stained longitudinal fracture **(Pathways of the pulp 12th edition)**

Chapter Two
Conclusion

Chapter Two
Conclusion

1. Endodontic emergencies are a common presentation to general dentists and specialist endodontists. The patients usually have significant pain that requires immediate and comprehensive management.

2. They are generally not something that can be managed quickly and this poses several challenges to a busy dentist or endodontist.

3. Endodontic emergencies require considerable time to manage them predictably so the patient and clinician can be confident that the pain will resolve very quickly.

4. The initial management should follow the principles of the 3-D's—that is, Diagnosis, Definitive dental treatment and Drugs—in that sequence. If these principles are followed, then the presenting problem and the pain are highly likely to resolve to a point where further treatment can be continued when it is convenient for both the patient and the dentist or endodontist.

5. Once the initial treatment has been provided, the principles of the 3R's should then be followed—that is, Review, Reassess and Reconsider. In most cases, only the first "R" will be required as the pain will usually resolve if appropriate and comprehensive treatment has been provided. However, if the pain has continued, or subsequently returned at a later time, then reassessment of the new problem must be undertaken so that the management can be reconsidered in the light of the revised diagnosis.

References

A

1. Abbott, P.V. (2022) Present status and future directions: Managing endodontic emergencies. International Endodontic Journal, 55(Suppl. 3), 778–803.
2. Albahaireh ZS, Alnegrish AS. Postobturation pain after Single and multiple-visit endodontic therapy: a prospective Study, J Dent 1998;26: 227.
3. American Association of Endodontics. Glossary of Endodontic terms ed 7 2003; American Association of Endodontists Chicago.
4. Auslander WP. The acute apical abscess, N Y State Dent J 1970;36: 623.
5. Azim, A., Azim, K. & Abbott, P.V. (2017) Prevalence of interappointment endodontic flare-ups and host-related factors. Clinical Oral Investigations, 21, 889–894.

B

6. Bence R, Meyers RD, Knoff RV. Evaluation of 5,000 endodontic treatment incidents of the open tooth, Oral
7. Bender IB. Pulpal pain diagnosis: a review, J Endod 2000;26: 175.
8. Beus H, Fowler S, Drum M, et al.: What is the outcome of an incision and drainage procedure in endodontic patients? a prospective, randomized, single-blind study, J Endod 44(2):193–201, 2018.
9. Boutsioukis C, Psimma Z, Kastrinakis E. The effect of Flow rate and agitation technique on irrigant extrusion ex Vivo, Int Endod J 2014;47: 487.

10. Bystrom A, Claesson R, Sundqvist G. The antibacterial Effect of camphorated paramonochlorophenol, Camphorated phenol and calcium hydroxide in the Treatment of infected root canals, Endod Dent Traumatol 1985;1: 170.

C

11. Calderon A: Prevention of apical periodontal ligament pain: a preliminary report of 100 vital pulp cases, J Endod 19(5):247–249, 1993.
12. Cameron CE. The cracked tooth syndrome, J Am Dent Assoc 1976;93: 971.
13. Campanelli CA, Walton RE, Williamson AE, et al.: Vital signs of the emergency patient with pulpal necrosis and localized acute apical abscess, J Endod 34(3):264–267, 2008.
14. Carr DB, Goudas LC: Acute pain, The Lancet 353:2051-2058, 1999.
15. Carrotte P. Endodontics. Part 3. Treatment of endodontic Emergencies, Br Dent J 2004;197: 299.
16. Carrotte, P. (2004) Endodontics: part 3. Treatment of endodontic emergencies. British Dental Journal, 197, 299–305.
17. Charara K, Friedman S, Sherman A, et al: Assessement of apical extrusion during root canal irrigation with the novel GentleWave system in a simulated apical environment, J Endod 2016;42: 135.
18. Chestner SB, Selman AJ, Friedman J, et al: Apical fenestration: solution to recalcitrant pain in root canal therapy, J Am Dent Assoc 1986;77: 846.
19. Chong BS, Pitt Ford TR. The role of intracanal medication in root canal treatment, Int Endod J 1992;25:97.

D

20. Dao TT, LeResche L: Gender differences in pain, J Orofac Pain14(3):169–184; discussion 184–195, 2000.
21. Desi P, Himel V. Comparative safety of various Intracanal irrigation systems, J Endod 2009;35: 545.
22. DiBernardi J, Fisch G, Rosenberg PA: Preoperative levels of anxiety as a predictor of successful local anesthesia, J Endod 35:432, 2009.
23. Dorn SO, Moodnik RM, Feldman MJ, et al: Treatment of The endodontic emergency: a report based on aQuestionnaire—part I, J Endod 1977;3: 94.
24. Dorn SO, Moodnik RM, Feldman MJ, et al: Treatment of The endodontic emergency: a report based on a Questionnaire—part II, J Endod 1977;3: 153.

E

25. Eleazer PD, Eleazer KR: Flare-up rate in pulpally necrotic molars in one-visit versus two-visit endodontic treatment, J Endod 24(9):614–616, 1998.
26. Eleazer PD, Eleazer KR. Flare-up rate in pulpally necrotic molars in one-visit versus two-visit endodontic treatment, J Endod 1998;24: 614.

F

27. Farmakis, E.-T., Palamidakis, F.D., Skondra, F.G., Nikoloudaki, G. & Pantazis, N. (2016) Emergency care provided in a Greek dental school and analysis of the patients' demographic characteristics: a prospective study. International Dental Journal, 66,280–286.

28. Field JW, Gutmann JL, Solomon ES, et al: A clinical Radiographic retrospective assessment of the success rate Of single-visit root canal treatment, Int Endod J 2004;37:70.
29. Fouad AF, Rivera EM, Walton RE: Penicillin as a supplement in resolving the localized acute apical abscess, Oral Surg Oral Med Oral Pathol Oral Radiol Endod 81(5):590–595, 1996.

G

30. Gatchel RJ. Managing anxiety and pain during dental treatment, J Am Dent Assoc 1992;123: 37.
31. Gatewood RS, Himel VT, Dorn S. Treatment of the Endodontic emergency: a decade later, J Endod 1990;16:284.
32. Genet JM, Hart AA, Wesselink PR, Thoden van Velzen SK: Preoperative And operative factors associated with pain after the first Endodontic visit, Int Endod J 20(2):53–64, 1987.
33. Gesi A, Hakeberg M, Warfvinge J, Bergenholtz G: Incidence of periapical lesions and clinical symptoms after pulpectomy—a clinical and radiographic evaluation of 1- versus 2-session treatment, Oral Surg Oral Med Oral Pathol Oral Radiol Endod 101(3):379–388, 2006.
34. Gopikrishna V, Parameswaran A: Effectiveness of prophylactic use of rofecoxib in comparison with ibuprofen on postendodontic pain, J Endod 29(1):62–64, 2003.
35. Gordon SM, Dionne RA, Brahim J, et al.: Blockade of peripheral neuronal barrage reduces postoperative pain, Pain 70(2-3):209–215, 1997.

H

36. Harrington GW, Natkin E. Midtreatment flare-ups, Dent Clin North Am 1992;36: 409.
37. Harrison JW, Baumgartner JC, Svec TA: Incidence of pain associated with clinical factors during and after root canal therapy. Part 2. Postobturation pain, J Endod 9(10):434–438, 1983.
38. Harrison JW. Irrigation of the root canal system, Dent Clin North Am 1984;28: 797.
39. Hasselgren G. Pains of dental origin, Dent Clin North Am 2000;12: 263.
40. Henry BM, Fraser JG. Trephination for acute pain Management, J Endod 2003;29: 144.
41. Henry M, Reader A, Beck M: Effect of penicillin on postoperative endodontic pain and swelling in symptomatic necrotic teeth, J Endod 27(2):117–123, 2001.
42. Holmes-Johnson E, Geboy M, Getka EJ. Behavior considerations, Dent Clin North Am 1986;30: 391.
43. Horrobin DF, Durnad LG, Manku MS. Prostaglandin E 1 Modifies nerve conduction and interferes with local Anesthetic action, Prostaglandins 1997;14: 103.

I

44. Imura N, Zuolo ML: Factors associated with endodontic flare-ups: A prospective study, Int Endod J 28(5):261–265, 1995.

K

45. Kvist T, Molander A, Dahlen G, et al: Microbiological Evaluation of one- and two-visit endodontic treatment of Teeth with apical periodontitis: a randomized, clinical Trial, J Endod 2004;30: 572.

L

46. Lee M, Winkler J, Hartwell G, et al: Current trends in Endodontic practice: emergency treatments and Technological armamentarium, J Endod 2009;35: 35.

47. Liesinger A, Marshall FJ, Marshall JG: Effect of variable doses of dexamethasone on posttreatment endodontic pain, J Endod 19(1):35–39, 1993.

48. Louis H. Berman, Kenneth M. Hargreaves (2021) COHEN'S PATHWAYS OF THE PULP, TWELFTH EDITION ISBN: 978-0-323-67303-7.

M

49. Mahmoud Torabinejad, Ashraf F. Fouad, Shahrokh Shabahang (2021) Endodontics Principles and Practice Sixth edition.

50. Marshall JC, al Naqqbi A: Principles of source Control in management of sepsis, Crit Care Clin 25(4):753-768, 2009.

51. Marshall JG, Walton RE: The effect of intramuscular injection of steroid on posttreatment endodontic pain, J Endod 10(12):584–588, 1984.

52. Matusow RJ, Goodall LB. Anaerobic isolates in primary pulpal–alveolar cellulitis cases: endodontic resolutions And drug therapy considerations, J Endod 1983;9: 535.

53. Menke ER, Jackson CR, Bagby MD, Tracy TS: The effectiveness Of prophylactic etodolac on postendodontic pain, J Endod 26(12):712–715, 2000.
54. Metka ME, Liem VML, Parsa A, et al: Cone-beam Computed tomographic scans in comparison with Periapical radiographs for root canal length Measurement: an in situ study, J Endod 2014;40: 1206.
55. Mitchell RP, Yang S, Baumgartner JC. Comparison of Apical extrusion of NaOCl using the EndoVac or needle Irrigation of root canals, J Endod 2010;36: 338.
56. Mohammadi Z, Abbott PV: On the local applications Of antibiotics and antibiotic-based agents in Endodontics and dental traumatology, Int Endod J 42:555-567, 2009.
57. Moos HL, Bramwell JD, Roahen JO. A comparison of pulpectomy alone versus pulpectomy with trephination for the relief of pain, J Endod 1996;22: 422.

N

58. Nusstein J, Reader A, Nist R, et al: Anesthetic efficacy of the supplemental intraosseous injection, J Endod 1998;24: 487.
59. Nyerere JW, Matee MI, Simon EN: Emergency pulpotomy in Relieving acute dental pain among Tanzanian patients, BMC Oral Health 6(1), 2006.

P

60. Pekruhn RB. The incidence of failure following singlevisit Endodontic therapy, J Endod 1986;12: 68.

61. Penesis VA, Fitzgerald PI, Fayad MI, et al: Outcome of One-visit and two-visit endodontic treatment of necrotic Teeth with apical periodontitis: a randomized controlled Trial with one-year evaluation, J Endod 2008;34: 251.
62. Peters LB, Wesselink PR. Periapical healing of Endodontically treated teeth in one and two visits Obturated in the presence or absence of detectable microorganisms, Int Endod J 2002;35: 660.
63. Pickenpaugh L, Reader A, Beck M, et al.: Effect of prophylactic amoxicillin on endodontic flare-up in asymptomatic, necrotic teeth, J Endod 27(1):53–56, 2001.

R

64. Reader A, Nusstein J, Drum M: Successful local anesthesia for restorative dentistry and endodontics, Hanover Park, Ill, 2011, Quintessence.
65. Reddy SA, Hicks ML. Apical extrusion of debris using Two hand and two rotary instrumentation techniques, J Endod 1998;24: 180.
66. Ricucci D, Langeland K: Apical limit of instrumentation and obturation. Part 2. A histological study, J Int Endod 31:394-409, 1998.
67. Rudner WL, Oliet S. Single-visit endodontics: a concept And a clinical study, Compend Contin Educ Dent 1981;2:63.
68. Rugh JD. Psychological components of pain, Dent Clin North Am 1987;31: 579.

S

69. Sandor GK, Low DE, Judd PL, et al: Antimicrobial Treatment options in the management of odontogenic Infections, J Can Dent Assoc 1998;64: 508-Comment in J Can Dent Assoc 65:602, 1999.

70. Sim CK: Endodontic interappointment emergencies in a Singapore private practice setting: a retrospective study of incidence and cause-related factors, Singapore Dent J 22(1):22–27, 1997.
71. Simon JH, Chimenti RA, Mintz GA. Clinical significance Of the pulse granuloma, J Endod 1982;8: 116.
72. Siqueira JF, Rocas IN. Microbial causes of endodontic flareups, Int Endod J 2003;36: 433.
73. Sjogren U, Figdor D, Persson S, et al: Influence of Infection at the time of root filling on the outcome of Endodontic treatment of teeth with apical periodontitis, Int Endod J 1997;30: 297.
74. Sjogren U, Hagglund B, Sundqvist G, et al: Factors affecting the long term results of endodontic treatment, J Endod 16:498-504, 1990.
75. Surg Oral Med Oral Pathol 1980;49: 82.

T

76. Torabinejad M, Cymerman JJ, Frankson M, et al.: Effectiveness Of various medications on postoperative pain following complete Instrumentation, J Endod 20(7):345–354, 1994.
77. Torabinejad M, Eby WC, Naidorf IJ: Inflammatory and immunological aspects of the pathogenesis of human periapical lesions, JEndod 11:479, 1985.
78. Torabinejad M, Kettering JD, McGraw JC, et al.: Factors associated with endodontic interappointment emergencies of teeth with necrotic pulps, J Endod 14(5):261–266, 1988.
79. Torabinejad M, Walton R. Endodontics: principles and Practice ed 4 2009;Saunders St. Louis.

80. Torabinejad M, Walton R. Endodontics: principles and practice ed 4 2009; Saunders St. Louis.
81. Torabinejad M, Walton RE: Managing endodontic emergencies, J Am Dent Assoc 122(5), 1991. 99, 101, 103.
82. Torabinejad M, Walton RE: Managing endodontic emergencies,J Am Dent Assoc 122:102, 1991.
83. Torabinejad M: Mediators of acute and chronic periradicular lesions, Oral Surg Oral Med Oral Pathol 78:511, 1994.
84. Trope M: Flare-up rate of single-visit endodontics, Int Endod J 24(1):24–26, 1991.
85. Trope M: Relationship of intracanal medicaments to endodontic Flare-ups, Endod Dent Traumatol 6(5):226–229, 1990.
86. Turkun M, Cengiz T. The effects of sodium hypochlorite And calcium hydroxide in tissue dissolution and root canal Cleanliness, Int Endod J 1997;30: 335.

V

87. Vera J, Ochoa J, Romero M, et al: Intracanal cryotherapy Reduces postoperative pain in teeth with symptomatic Apical periodontitis: A randomized multicenter clinical Trial, J Endod 2018;44: 4.

W

88. Walker, R.T. (1984) Emergency treatment—a review. International Endodontic Journal, 17, 29–35.
89. Walton R, Fouad A: Endodontic interappointment flare-ups: a prospective Study of incidence and related factors, J Endod 18(4):172–177, 1992.

90. Walton RE, Chiappinelli J: Prophylactic penicillin: effect on posttreatment symptoms following root canal treatment of asymptomatic periapical pathosis, J Endod 19(9):466–470, 1993.
91. Weiger R, Rosendahl R, Lost C. Influence of calcium Hydroxide intracanal dressings on the prognosis of teeth With endodontically induced periapical lesions, Int Endod J 2000;33: 219.
92. Weine FS, Healey HJ, Theiss EP. Endodontic emergency dilemma: leave tooth open or keep it closed?, Oral Surg Oral Med Oral Pathol 1975;40: 531.
93. Wolcott, J., Rossman, L. & Hasselgren, G. (2011) Management of Endodontic emergencies. In: Hargreaves, K.M. & Cohen, S.(Eds.) Pathways of the pulp, 10th edition. St Louis, MO: Mosby Elsevier, pp. 40–48.