

A Clinician's Guide to Clinical Endodontics



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Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

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Conflict of Interest Disclosure Statement

- The author reports no conflicts of interest associated with this course. There are no relevant financial relationships to disclose.

Short Description

A Clinician's Guide to Clinical Endodontics is a free dental continuing education course that covers a wide range of topics relevant to the oral healthcare professional community.

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Overview

The field of endodontics is always evolving. It is important for health care providers to continue to recognize the changes overtime and apply them in everyday practice. This course will explore diagnosis, local anesthesia, instrumentation/obturation, and pain medications and antibiotics in clinical endodontic treatment.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Describe the clinical tests needed to obtain a pretreatment pulpal and periapical diagnosis.

- Describe the correct pulpal and periapical diagnosis terms in endodontics.
- Explain how to objectively test for pulp anesthesia.
- Explain how to integrate supplemental anesthesia techniques.
- Describe the modified crown-down filing technique.
- Explain the importance of removing residual canal debris.
- Discuss the current recommended NSAIDs for postoperative pain after conventional endodontic treatment.
- Discuss the current antibiotic recommendations for endodontic therapy.

Introduction

Successful endodontic treatment is predicated on obtaining a pretreatment pulpal and periapical diagnosis. The pretreatment pulpal and periapical diagnosis of a tooth begins with a review of the patient's medical and dental history. Pretreatment also includes taking a patient's blood pressure, pulse, and temperature (if indicated). If a patient presents in pain, the etiology of the pain must be identified before any emergency dental treatment is performed. The first step in determining this etiology is listening to the patient's description of the problem, followed by a dentist's objective clinical testing to reproduce the patient's subjective pain symptoms.

If a patient presents with an asymptomatic dental condition, as often occurs in restorative dentistry, the same objective tests described below must be completed to properly make a pretreatment pulpal and periapical diagnosis. To arrive at a proper pretreatment pulpal and periapical diagnosis, clinicians should be aware of which tests to perform. The following are the five objective clinical tests that a dentist may use to determine the pulpal and periapical diagnosis.

Clinical Tests

Cold Test, EPT, and/or Heat Test for Pulp Sensibility

Pulp sensibility tests (thermal and electric) have been used to indirectly determine the state of pulpal health by assessing the condition of the dental pulp nerves. Pulp vitality, on the other

hand, is the direct assessment of pulp blood flow.¹ This assessment is obtained with laser doppler flowmetry (LDF) or pulse oximetry (PO). The reason clinicians perform sensibility tests rather than pulpal vitality tests is that LDF and PO applications in dentistry are limited (i.e., they have not been designed for specific usage in dentistry).

Heat and cold tests do not jeopardize the health of the pulp.² Additionally, teeth with porcelain or metal crowns conduct temperature and, therefore, can be tested for pulpal sensibility with cold or heat.³

With an electric pulp test (EPT), the clinician should understand what the numerical readings represent. Although an EPT can help determine pulp sensibility, the numerical readout should not be used to determine the overall health of the pulp.⁴ For example, if tooth No. 8 has an EPT reading of 12 and tooth No. 9 has an EPT reading of 24, it does not mean tooth No. 8 is twice as vital as tooth No. 9. The EPT is used to determine whether the pulp is vital, meaning whether you have a negative (no) reading (an 80) or a positive reading (a response to any number below 80). In addition, when using an EPT, the clinician must be aware that teeth with metal restorations can give false-positive or false-negative responses.

Weisleder et al⁵ reported that the cold test and EPT used in conjunction resulted in a more

accurate method for proper pulpal diagnostic testing. In another study, Jespersen et al⁶ reported that a pulp-testing spray and EPT are accurate and reliable methods for determining pulpal sensibility.

Percussion Tests for Determining the Status of the Periodontal Ligament

Percussion tests may be considered mistakenly to directly correlate to a pulp's sensibility. Although a tooth's sensitivity to percussion tests may be due to a pulpitis or pulpal necrosis, they are only indirectly associated. This specific test aids only in determining the status of the periodontal ligament (Figure 1). A bite test may also be necessary if a patient complains about pain while masticating.

Palpation of the Buccal and Lingual/Palatal Gingival Tissue of the Tooth

A palpation examination tests for sensitivity of the gingival tissue and for infection or inflammation of the cortical and medullary bone (Figure 2). Even when there is no 2 dimensional radiographic evidence of an apical infection, an infection may be present clinically. A study by Bender et al⁷ reported it is not uncommon to have extensive disease of the bone without evidence on a 2 dimensional radiograph. Three dimensional imaging techniques such as localized small field of view CBCT images can be helpful to identify periapical lesions missed in 2 dimensional imaging.



Figure 1. Percussion testing on tooth No. 19 performed by tapping the buccal tooth surface with the opposite end of a dental mirror.



Figure 2. Palpation testing on tooth No. 19 performed by pressing index finger around the buccal and lingual gingiva.

Periodontal Examination Including Periodontal Probing and Tooth Mobility

Periodontal disease can develop anywhere around a tooth; therefore, the entire circumference of the tooth, or teeth, must be probed.

When evaluating tooth mobility, the clinician must remember that movement may be endodontic or periodontal in nature. In the case of periodontal disease, the tooth begins to become mobile and loosens as the attachment apparatus and surrounding bone are destroyed. With an acute endodontic infection, mobility is generally associated with an isolated tooth, but when there is generalized mobility involving multiple teeth, mobility suggests a periodontal origin. The cause may not be determined from periodontal probing alone as both periodontal and endodontic causes may exist simultaneously, or one may be causing the other (e.g., an endodontic infection draining from the apex causing a periodontal pocket and deep probing).

Current Radiographic Examination Including Periapical, Bitewings, and/or CBCT

Uraba et al reported that cone-beam computed tomography (CBCT) imaging is effective at detecting approximately 20% more periapical lesions than are periapical radiographs, particularly in the maxillary anterior and posterior teeth.⁸

When a patient presents for restorative treatment and reports that a tooth is asymptomatic, a dentist may assume that the pulpal and periapical diagnosis is within normal limits and hence may skip the above objective clinical tests, with the possible exception of taking a radiograph. However, using only a dental radiograph to determine the etiology of tooth pain and the pretreatment pulpal and periapical status may lead to a pulpal and periapical misdiagnosis (Figure 3). Therefore, a clinician must perform all five objective tests to obtain an accurate pretreatment pulpal and periapical diagnosis.

Pulpal Diagnosis

The pulpal nerve fibers, A-delta (which respond to cold and the EPT) and C-fibers (which elicit

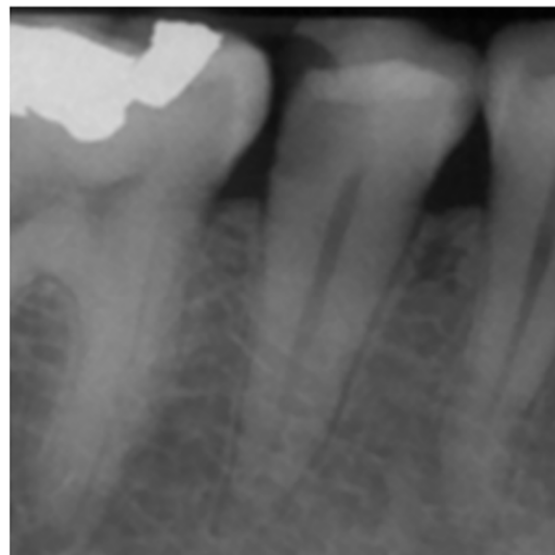


Figure 3. Determining a diagnosis with a radiograph only can lead the clinician to treat tooth No. 29 because of the distal decay. However, if the proper diagnostic tests are performed on tooth No. 29, it should reveal the pulp tested necrotic and it is tooth No. 30 that has a symptomatic irreversible pulpitis and was the patient's chief complaint.

the nerve response when a patient reports spontaneous tooth pain), are nociceptors. Nociceptors are sensory receptors that respond to stimuli by sending nerve signals to the brain. This stimulus can cause the perception of pain in an individual.⁹ By objectively testing the pulpal nerve fibers, a dentist can best determine pulpal status. Below are the current pulpal diagnosis terminologies.¹⁰

Normal pulp tests within normal limits to cold and/or EPT. Clinically, a patient will respond to a cold stimulus, and after the stimulus is removed, the cold sensation will dissipate immediately. The length of time it takes for a patient to respond to cold has no correlation to the diagnosis and therefore does not need to be recorded.

Reversible pulpitis is pain from an inflamed pulp that can be treated without the removal of the pulp tissue (it is a reversible condition). It is not a disease, but a symptom. Classic clinical symptoms are sharp, quick pain that subsides as soon as the stimulus is removed or pain when getting food caught in caries or when eating sweets. Physiologically, it is the A-delta fibers that are firing, not the C-fibers of the pulp.¹¹ A-delta

fibers are the myelinated, low-threshold, sharp/pricking pain nerve fibers that reside principally in the pulp-dentin junction. They can be stimulated by cold and the EPT and cannot survive in a hypoxic (low oxygen) environment. Reversible pulpitis also does not involve an unprovoked (spontaneous) response.

Symptomatic irreversible pulpitis is an inflamed pulp that cannot be treated except by the removal of the pulp tissue (it is an irreversible condition). Classic clinical symptoms are lingering of cold/hot stimulus greater than 5 seconds and/or patient reporting of spontaneous tooth pain. Physiologically, the A-delta fibers and/or the C-fibers can fire the neural impulses. C-fibers are the unmyelinated, high-threshold, aching-pain nerve fibers. They are distributed throughout the pulp. They can survive in a hypoxic environment.

Asymptomatic irreversible pulpitis is a vital pulp that is incapable of healing, and endodontic treatment is consequently indicated. Although asymptomatic irreversible pulpitis is actually a histologic diagnosis to determine the inflammatory extent of the pulp, clinical examples of this diagnosis include a pulp polyp (Figure 4), or a carious pulp exposure of an asymptomatic tooth.

Pulpal necrosis can result from an untreated irreversible pulpitis or immediately after a traumatic injury that disrupts the vascular system of the pulp. A necrotic pulp does not respond to cold tests, EPT, or heat tests.

Previously treated: A tooth that has already been endodontically treated.

Previously initiated therapy: Endodontic treatment was started on a tooth but not completed with obturation.

Periapical Diagnosis

When clinicians perform restorative or endodontic treatment, they often do not obtain a periapical diagnosis. However, making a periodontal diagnosis is especially helpful when a patient presents in pain. A study by McCarthy et al¹² demonstrated that patients presenting with periapical pain can localize the painful tooth 89% of the time and that patients who present with

tooth pain without periapical pain can localize the tooth only 30% of the time.

By objectively testing the periapical tissue, a dentist can best determine its gingival and periapical status. Below are the current periapical diagnosis terminologies.¹⁰

Normal periodontal tissue: Not sensitive to percussion or palpation testing. Also, radiographically, the lamina dura surrounding the root is intact.

Symptomatic apical periodontitis: The tooth has a painful response to biting and/or percussion. This may or may not be accompanied by radiographic periapical changes.



Figure 4. A pulp polyp is a clinical example of an asymptomatic irreversible pulpitis diagnosis.



Figure 5. Clinical confirmation of the periapical diagnosis—chronic apical abscess on tooth No. 19. The tooth is not sensitive to percussion or palpation. A gutta-percha cone is inserted into the sinus tract.

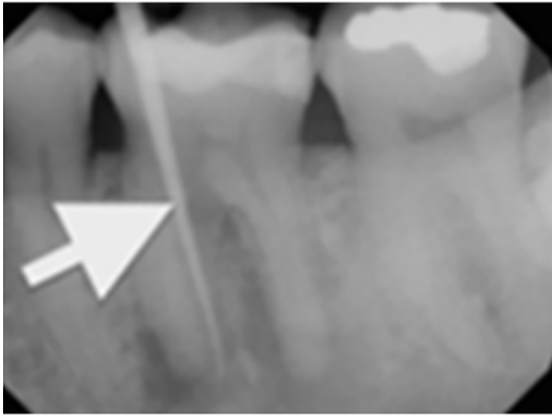


Figure 6. Radiographic confirmation of periapical diagnosis—chronic apical on tooth No. 19. Note the tracing of the inserted gutta-percha to the etiology.



Figure 7. An electric pulp test (EPT) is used to test a treatment tooth before and after giving local anesthesia to confirm profound pulpal anesthesia.

Asymptomatic apical periodontitis: The tooth has no pain on percussion or palpation. Radiography reveals a periapical radiolucency.

Chronic apical abscess: Radiography typically reveals a periapical radiolucency, but a periapical radiolucency is not required for this diagnosis. Clinically, there is a sinus tract present on the gingival tissue. The draining sinus tract should be traced with a gutta-percha cone and then confirmed radiographically (Figure 5 and Figure 6).

Acute apical abscess is an inflammatory reaction to pulpal infection and necrosis characterized by rapid onset, spontaneous pain, extreme tenderness of the tooth to pressure, pus formation, and swelling of associated tissues. There may be no radiographic signs of destruction.

Condensing osteitis is a diffuse radiopaque lesion in the periapical region. The opacity represents a localized osseous reaction to a low-grade inflammatory stimulus.

Local Anesthesia

A dentist must obtain profound anesthesia when providing endodontic treatment. A common mistake that clinicians may make when attempting to get a patient “numb” is to not objectively test whether pulpal anesthesia has been achieved before initiating endodontic treatment. Often, the only determination of whether a patient is properly anesthetized is the “subjective” anesthesia level as reported by the patient.

Studies have demonstrated that inferior alveolar nerve (IAN) anesthetic blocks administered to patients with mandibular teeth diagnosed with irreversible pulpitis on average had only a 55% incidence of profound pulpal anesthesia, even in the presence of 100% lip numbness as reported by the patient.^{13,14}

Therefore, before giving local anesthesia for endodontic treatment, the dentist should objectively test the treatment tooth with a cold test and/or EPT. With a preoperative baseline of the pulp sensibility level, after anesthesia is “onboard,” the level of anesthesia can be accessed by re-testing the treatment tooth with cold or EPT (Figure 7). If the post-anesthesia tests are either negative to cold or reveal no response to EPT, there is a high likelihood that profound pulpal anesthesia has been achieved. It is important to note that teeth with metal restorations can provide a false-positive result when using the EPT. Additionally, a study by Fuss et al¹⁵ reported that in young patients, the EPT was less reliable than cold tests.

Supplemental Local Anesthesia

If profound anesthesia cannot be achieved with a block or infiltration alone (as determined from objective testing), supplemental anesthesia should be administered. Examples of supplemental local anesthesia are periodontal ligament, intraosseous, and intrapulpal injections.

Choosing the Correct Local Anesthetic

In conjunction with integrating regional and

supplemental local anesthesia, selecting the correct type of local anesthesia plays an important role in a clinician's ability to obtain profound pulpal anesthesia.

Regional Block

When giving a regional block, such as an IANB, the dentist should administer 1 cartridge of an anesthetic and then wait a few minutes to observe whether the patient reports any subjective signs ("feeling numb" or "feeling my lip or cheek is fat").

If the patient states that he or she feels the anesthetic is taking effect, the clinician did not miss the anatomical block and should proceed with testing the tooth for numbness. If the patient does not report "feeling numb" or any other subjective equivalent, it is a sign that either the anatomical block was missed or there was not enough concentration of base "onboard" to penetrate the nerve sheath and the clinician should inject another cartridge of anesthetic. If lip numbness occurs but the tooth is still responding to testing, the clinician should move on to administration of supplemental injections.

Since the introduction of articaine into the US market, there have been studies that have demonstrated there is no significant difference between 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine in IANB anesthesia.^{16,17} It is important to note that studies have reported a higher incidence of paresthesia when articaine has been administered for IANB. Although the exact etiology of the paresthesia is unknown, it is hypothesized that the neurotoxicity may be due to the higher concentration of local anesthesia used: 4% articaine as compared with 2% lidocaine.^{18,19} The clinician must consider these risks along with the benefits of administering 4% articaine for IANB anesthesia.

Buccal Block

In anesthesia for a buccal block, the use of 4% articaine with 100,000 epinephrine should be the drug of choice.¹⁷ A study by Srinivasan et al²⁰ reported that the efficacy of 4% articaine with 100,000 epinephrine was superior to 2% lidocaine with 100,000 epinephrine for buccal infiltrations in maxillary posterior teeth. Another study, by Brandt et al,¹⁶ demonstrated better pulpal

anesthesia with articaine versus lidocaine when using it as an infiltration local anesthesia.

Periodontal Ligament Block

The use of 2% lidocaine with 100,000 epinephrine has been demonstrated to be significantly better in achieving pulpal anesthesia through a periodontal ligament injection than using a local anesthetic without a vasoconstrictor.^{21,22} Repeated periodontal ligament injections in multiple areas around the tooth may be necessary to increase the volume and success of the injection.

Intraosseous Block

Although the literature supports the use of an anesthetic with vasoconstrictor for administering for an intraosseous block,²³ the clinician needs to be aware that this will temporarily increase heart rate in most patients.²⁴ Therefore, the clinician needs to balance a longer anesthetic effect along with a patient's tachycardia response versus using 3% mepivacaine (with no epinephrine) and eliminating the cardiac effect but shortening the duration of the local anesthetic effect. A study by Reisman et al²⁵ reported that when a repeated intraosseous injection with 3% mepivacaine (with no epinephrine) was administered, there was an increase in anesthetic success to 98%.

Intrapulpal Block

The main objective in administering an intrapulpal anesthesia is to give it under pressure. Although it has been stated in the scientific literature that saline is as effective as 2% lidocaine with 1:100,000 epinephrine in providing anesthesia intrapulpally,^{26,27} the clinician may use 2% lidocaine with 1:100,000 epinephrine.

NSAID and Nitrous Oxide Usage Preoperatively Before Local Anesthesia

In a recent systematic review with meta-analysis and trial sequential analysis by Nagendrababu et al,²⁸ it was reported that a preoperative oral dosage of ibuprofen greater than 400 mg can increase the success of local anesthesia when an IANB is used on patients with irreversible pulpitis. The report also stated that ketorolac 10 mg and diclofenac 50 mg are effective alternative premedications that have shown to increase the efficacy of IANB in patients with irreversible pulpitis. Nitrous oxide has been found to increase the success rate of local anesthesia in mandibular posterior teeth with symptomatic irreversible pulpitis.²⁹

Conventional Endodontic Treatment

For both cleaning and shaping and obturation techniques, there are many ways to perform these techniques. The most basic technique is described below but readers are encouraged to seek other technique advice from textbooks and literature.

After proper diagnosis and profound local anesthesia, a dentist can then proceed with clinical conventional endodontic treatment in performing a pulpectomy (the complete removal of the pulp tissue) while using a rubber dam to isolate the treatment tooth. For a pulpectomy, chemomechanical preparation of the entire root-canal system should be performed. This type of chemomechanical canal preparation involves using endodontic files, sodium hypochlorite, and ethylenediaminetetraacetic acid (EDTA) gel placement on each file (Figure 8). Also, if the dentist is not doing a single-visit treatment, calcium hydroxide may be placed in the canal(s) before temporizing the tooth.¹⁶

Modified Crown-Down Filing Technique

Initially, hand files should be used to access the root canal, create a glide path, and determine working length. Hand files should then enlarge the canal at working length to at least a 15/.02 to 20/.02 file size. The size will depend on the actual tooth that is being treated. After this step, rotary-file instrumentation should be initiated. It has been documented in scientific literature that rotary nickel-titanium (NiTi) files can prepare a canal faster than hand files.³¹

Although there are many different file techniques for conventional endodontic treatment, the modified crown-down technique is a consistent and efficient method of treatment.³² The technique involves opening the coronal two-thirds of the canal with rotary files. Several types of “orifice opener” rotary files are on the market. Next, the rotary files should be worked from larger- to smaller-size files working your way to the final working length. It is recommended to use a 0.04 taper rotary-file system when preparing the root canal for obturation. The last rotary-file size that can be taken to working length in a canal is considered the master apical file and in most basic cases should be no smaller than a size 30 or 25.

A clinician must use a rubber dam for tooth isolation when performing endodontic treatment as this is considered standard of care.

Residual Canal Debris

Residual canal debris is organic and/or inorganic material that remains on the dentinal wall after conventional endodontic chemomechanical canal preparation is completed.³³ This residual canal debris is also referred to as the smear layer. The organic and/or inorganic substance is derived from ground dentin; pulpal remnants; and, in cases of infected root-canal systems, bacteria.³⁴

A possible explanation for the residual canal debris after chemomechanical canal preparation is that NiTi rotary files remain centered in the canal and therefore will not make contact with all the dentinal walls due to various invaginations and irregularities.³⁵ An *in vitro* study by Chuste-Guillot demonstrated that regardless of which NiTi rotary-file system a clinician used to prepare an infected root-canal system, the root dentin that remained was infected and not bacteria-free.³⁶ Lin et al reported that the major factors associated with endodontic failures were the persistence of bacterial infection in the canal space and/or the periapical area.³⁷

Another explanation for the presence of residual canal debris after canal instrumentation and irrigation may be that a clinician is not being vigilant in using EDTA and sodium hypochlorite.³⁸ Lastly, canal morphology can be complex, making it difficult for the chemomechanical canal

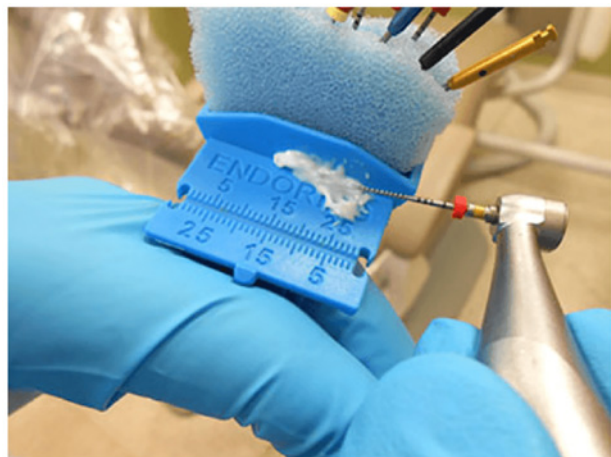


Figure 8. The placing of an EDTA gel on an endodontic file before placement in a canal.

preparation to be effective in removing all the canal debris.³⁹

The three main factors in removing residual canal debris are irrigation activation, mechanical debridement, and chemical debridement. Effective irrigation techniques such as ultrasonic activation, multisonic activation or laser energy are beyond the scope of this review. Readers are encouraged to seek additional information and training in the use of those techniques.

Obturation

The clinical goal of endodontic obturation of a root-canal system is to create the best seal possible from the coronal restoration to the apex.⁴⁰ Although gutta-percha has been a consistent material used in canal obturation for the last 40 years, techniques and sealers have changed during that time. Various techniques, such as lateral compaction, warm vertical compaction, and carrier-based obturation, have been reported in the scientific literature.^{41,42} With regard to sealers, the most current trend is the bioceramic sealer.⁴³ It has been reported that bioceramic sealers are nontoxic, are hydrophilic, expand upon setting, and are antimicrobial.⁴⁴

Pain Medication and Antibiotics

The most consistent predictive factor for postoperative endodontic pain is the presence of preoperative hyperalgesia (spontaneous pain, reduced pain threshold, and/or increased perception of noxious stimuli).⁴⁵ A clinical study by Ali et al⁴⁶ showed that postoperative pain was present in 54.5% of patients treated. A common clinical mistake in endodontic-treatment pain management is prescribing drugs after treatment without critically assessing whether the drugs are pharmacologically treating inflammation and/or infection. An example would be prescribing antibiotics for tooth pain that has an inflammatory rather than an infection etiology. Fouad⁴⁷ reported that antibiotics do not have an analgesic effect on odontogenic inflammatory pain. The pretreatment endodontic and periapical diagnosis is a clinical guide for determining inflammation and/or infection. If the treatment diagnosis is irreversible pulpitis with or without symptomatic apical periodontitis, the condition is strictly inflammation, and anti-inflammatory drugs (NSAIDs) are the medication of choice.

Significant reduction in odontogenic pain from inflammation can be seen from 400 mg to 800 mg of ibuprofen.⁴⁸ A recent study by Taggar et al⁴⁹ reported that ibuprofen sodium dihydrate provided faster pain relief than ibuprofen acid. In cases when ibuprofen alone is not effective in reducing postoperative pain for an endodontic patient, administering a combination of ibuprofen and acetaminophen can produce significantly effective pain management for odontogenic-type inflammation.⁵⁰ Acetaminophen, alone or in combination with an opioid (eg, hydrocodone), is a good alternative analgesic for a patient who cannot take NSAID medication.³³

There will be cases in which NSAIDs do not relieve a patient's odontogenic postoperative pain. Although opiate medications are commonly prescribed in these scenarios, a dentist also could consider prescribing dexamethasone, a synthetic adrenocortical steroid.⁵¹

If there is an odontogenic infection with active swelling and/or a fever, a patient should additionally be placed on an antibiotic.

Antibiotic treatment may be necessary for preventing the spread of infection, in acute apical abscesses with systemic involvement, and for progressive and persistent infections.⁵² Systemic involvement in clinical infection can appear as fever, swelling, malaise, a compromised airway, or cellulitis, as well as in a medically compromised patient. A compromised airway requires immediate emergency medical intervention in a hospital setting.

Penicillin V potassium (pen VK) has been documented in the scientific literature as the antibiotic of choice for endodontic infections.⁵³ It has been demonstrated that the pen VK spectrum of antimicrobial activity includes many of the bacteria that have been isolated in endodontic infections.⁵⁴ Segura-Egea et al⁵² reported that amoxicillin or amoxicillin with clavulanic acid showed a better absorption, higher blood levels, better tissue penetration, and fewer adverse side effects than pen VK. Amoxicillin and amoxicillin with clavulanic acid have a wider spectrum of activity than pen VK.⁵⁵ This spectrum includes many species of

bacteria found elsewhere in the body and may increase the risk of selecting bacteria resistant outside the oral cavity. However, amoxicillin and amoxicillin with clavulanic acid are indicated for the treatment of immunocompromised patients who may have odontogenic infections containing non-oral bacteria.⁵⁴

For the patient allergic to penicillin/amoxicillin or if penicillin/amoxicillin has been ineffective, clindamycin is the second antibiotic of choice. Clindamycin is beta-lactamase resistant (unlike pen VK) and has a good spectrum against gram-positive and gram-negative bacteria.⁵⁵ Another option if pen VK is ineffective is to add metronidazole along with the pen VK. Metronidazole should not be given as the sole antibiotic, but rather in combination with pen VK. Metronidazole has a narrow therapeutic spectrum against obligate anaerobic bacteria.⁵⁶

When prescribing antibiotics, it may be useful to use a loading dose. Antibiotics with long half-lives can require several days of therapy to achieve effectiveness. In addition, the most critical time for antibiotic effectiveness is the first 24 hours,

which is typically when inoculum of infection is high and likely to harbor resistant subpopulations of bacteria.^{57,58}

Scientific literature has stated that clinicians prescribe antibiotics in courses of 3 to 7 days.⁵⁹ Some evidence suggests that perhaps shorter courses (2 to 3 days) of antibiotic therapies may be as successful.⁶⁰ The use of amoxicillin for 7 days has been shown to increase the population of resistant strains of bacteria.⁶¹ In addition, the dentist should be in close contact with the patient who is taking antibiotics in the event that clinical symptoms worsen or there is a drug allergy.⁶²

Conclusion

Although the clinical advances and changes in thought within the field of endodontics have been significant in recent years, general dentists and associated professionals who become educated on the changes will remain up-to-date. By explaining currently accepted practices in endodontics regarding diagnosis, local anesthesia, instrumentation/obturation, and pain medications and antibiotics, this course serves as a guide for clinicians to stay updated in the field.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/ce562/start-test

- 1. The pretreatment pulpal and periapical diagnosis of a tooth begins with _____.**
 - A. taking a cone-beam computed tomography (CBCT) scan of the tooth or teeth in question.
 - B. cold-testing the tooth or teeth in question.
 - C. reviewing the patient's medical and dental history.
 - D. percussing the tooth or teeth in question.

- 2. The first step in determining a patient's tooth pain etiology is _____.**
 - A. listening to the patient's description of the problem.
 - B. performing objective tests of the tooth or teeth in question.
 - C. prescribing pain medications.
 - D. taking radiographic imaging.

- 3. The difference between pulp sensibility tests and pulp vitality tests is _____.**
 - A. pulp sensibility assesses the blood flow and pulp vitality assesses the condition of the nerve.
 - B. pulp sensibility assesses the condition of the nerve and pulp vitality assesses the blood flow.
 - C. pulp sensibility uses a laser Doppler flowmetry or pulse oximetry.
 - D. Two of the above.

- 4. Percussion tests determine _____.**
 - A. the status of the pulpal nerves.
 - B. the health of the gingival tissue.
 - C. the status of the periodontal ligament.
 - D. the status of the pulpal blood flow.

- 5. Uraba et al reported that CBCT imaging is effective at detecting approximately which percentage more periapical lesions than are periapical radiographs?**
 - A. 10%
 - B. 39%
 - C. 20%
 - D. 5%

- 6. The pulpal diagnosis of reversible pulpitis is _____.**
 - A. pain from an inflamed pulp that cannot be treated without the removal of the pulp tissue.
 - B. pain from an inflamed pulp that can be treated without the removal of the pulp tissue.
 - C. not a disease, but a symptom.
 - D. B and C

- 7. A pulpal diagnosis of symptomatic irreversible pulpitis is _____.**
 - A. an inflamed pulp that can be treated without the removal of the pulp tissue.
 - B. an inflamed pulp that cannot be treated except by the removal of the pulp tissue.
 - C. a diagnosis that determines the health of the periodontal ligament of a tooth.
 - D. A and C

- 8. Which of the following statements is true in regard to the periapical diagnosis of chronic apical abscess?**
- A. The draining sinus tract should be traced with a gutta-percha cone and then confirmed radiographically.
 - B. The radiograph typically does not reveal a radiolucency.
 - C. The sinus tract does not need to be traced.
 - D. B and C
- 9. Before giving local anesthesia to a patient _____.**
- A. the dentist should objectively test the treatment tooth with a cold test and/or electric pulp test (EPT).
 - B. the dentist does not need to objectively test the treatment tooth with a cold test and/or EPT.
 - C. no testing is necessary.
 - D. only subjective testing is necessary.
- 10. If profound anesthesia cannot be achieved with a regional block alone, supplemental anesthesia should be administered, such as _____.**
- A. periodontal ligament injections.
 - B. an inferior alveolar nerve block (IANB).
 - C. a superior alveolar nerve block (SANB).
 - D. topical anesthesia.
- 11. Which of the following is NOT involved in chemomechanical root-canal preparation?**
- A. rotary files
 - B. sodium hypochlorite
 - C. hand files
 - D. amoxicillin
- 12. When initiating a modified crown-down filing technique _____.**
- A. hand files should be used to access the canal, create a glide path, and determine working length.
 - B. rotary files should be used to access the canal, create a glide path, and determine working length.
 - C. ultrasonic files should be used to access the canal, create a glide path, and determine working length.
 - D. hand files should be used to access the canal, create a glide path and ultrasonic files should be used to determine working length.
- 13. The modified crown-down technique involves using _____.**
- A. rotary files to open the coronal two-thirds of the canal.
 - B. hand files larger to smaller to working length
 - C. ultrasonics to open the coronal two-thirds of the canal.
 - D. sodium hypochlorite used out the apex.
- 14. Use of which of the following should be considered standard of care in endodontic treatment?**
- A. Ultrasonic
 - B. CBCT
 - C. EDTA
 - D. Rubber dam

- 15. Residual canal debris is defined as _____.**
- A. organic and/or inorganic material that remains on the dentinal wall after conventional endodontic chemomechanical canal preparation is completed.
 - B. a separated endodontic file.
 - C. remnants seen on the pulpal floor.
 - D. missed canal anatomy.
- 16. Which of the following is NOT a possible explanation(s) for residual canal debris is/are _____.**
- A. NiTi files remain centered in the canal and therefore will not make contact with all the dentinal walls.
 - B. clinicians are not vigilant in using EDTA and sodium hypochlorite.
 - C. canal morphology can be complex.
 - D. sodium hypochlorite removes all material from the root canal system.
- 17. The most current trend in regard to sealers is _____.**
- A. AH+ sealer.
 - B. bioceramic sealers.
 - C. zinc oxide and eugenol sealers.
 - D. sealer-infused gutta-percha.
- 18. The most consistent predictive factor for postoperative endodontic pain is _____.**
- A. multi-roots on a tooth.
 - B. not using local anesthesia when performing endodontic treatment.
 - C. preoperative hyperalgesia.
 - D. a patient's age and weight.
- 19. It has been reported that significant reduction in odontogenic pain from inflammation can be seen from _____.**
- A. oxycodone.
 - B. 400 mg to 800 mg of ibuprofen.
 - C. using a chlorhexidine mouthrinse.
 - D. SSRIs.
- 20. In a study by Segura-Egea et al, which antibiotic was more effective and had fewer side effects than pen VK?**
- A. amoxicillin or amoxicillin with clavulanic acid
 - B. clindamycin
 - C. metronidazole
 - D. tetracycline.

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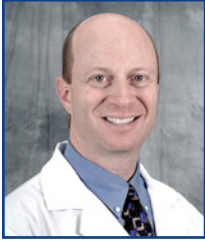
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Additional Resources

- No Additional Resources Available

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