

# 6

## Endodontic Case Complexity and Working with the Specialist

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### LEARNING OBJECTIVES

After reading this chapter, the student should be able to:

1. Evaluate the multiple factors that determine case difficulty and potential need for referral.
2. Identify the indications for referral to an endodontic specialist.
3. Explain the major differences in predoctoral training in endodontics and advanced specialty training in endodontics.
4. Describe differences in quantity and type of endodontic treatment performed by general dentists and endodontists in the United States.
5. Describe the optimal methods of communication between the general dentist and the endodontist.
6. Define the standards of care for endodontic treatment.
7. Identify the important elements of record keeping with respect to endodontic treatment.

### Introduction

Dentistry is one of the most trusted professions in the United States, routinely ranked among the top five in surveys that ask the public to rate the honesty and ethical standards of people in different fields.<sup>1</sup> This high level of trust has been earned by generations of dentists who have consciously chosen to act in their patients' best interests. Perhaps nowhere else in the practice of endodontics is the responsibility to act in the patient's best interests more relevant than initial evaluation of case complexity and deciding whether to treat or refer to a specialist. The American Dental Association (ADA) Code of Ethics addresses the duty to refer, when indicated, by stating: "*The dentist's primary obligations include keeping knowledge and skills current, knowing one's own limitations and when to refer to a specialist or other professional...*"<sup>2</sup>

Although the definition of standard of care still varies somewhat by location, most states have moved away from a local, experience-based standard of care to acceptance of a national, evidence-based standard of care.<sup>3</sup> The standard of care for endodontic therapy is the same for specialists and general dentists; therefore, if case difficulty assessment determines that the procedure is beyond the level of skill and experience of the general dentist, referral to an endodontic specialist is indicated.<sup>4</sup> This chapter provides an overview of specialty training requirements, standard of care, communication between general dentists and specialists, and a more detailed review of evaluation of case complexity. The American Association of Endodontists (AAE) Endodontic Case Difficulty Assessment Form (Fig. 6.1) will be presented with guidance for clinical use.



## AAE Endodontic Case Difficulty Assessment Form and Guidelines

### PATIENT INFORMATION

Name \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Phone \_\_\_\_\_

### DISPOSITION

Treat in Office: Yes ☐ No ☐

Refer Patient to: \_\_\_\_\_

Date: \_\_\_\_\_

## Guidelines for Using the AAE Endodontic Case Difficulty Assessment Form

The AAE designed the Endodontic Case Difficulty Assessment Form for use in endodontic curricula. The Assessment Form makes case selection more efficient, more consistent and easier to document. Dentists may also choose to use the Assessment Form to help with referral decision making and record keeping.

Conditions listed in this form should be considered potential risk factors that may complicate treatment and adversely affect the outcome. Levels of difficulty are sets of conditions that may not be controllable by the dentist. Risk factors can influence the ability to provide care at a consistently predictable level and impact the appropriate provision of care and quality assurance.

The Assessment Form enables a practitioner to assign a level of difficulty to a particular case.

### LEVELS OF DIFFICULTY

MINIMAL DIFFICULTY	Preoperative condition indicates routine complexity (uncomplicated). These types of cases would exhibit only those factors listed in the MINIMAL DIFFICULTY category. Achieving a predictable treatment outcome should be attainable by a competent practitioner with limited experience.
MODERATE DIFFICULTY	Preoperative condition is complicated, exhibiting one or more patient or treatment factors listed in the MODERATE DIFFICULTY category. Achieving a predictable treatment outcome will be challenging for a competent, experienced practitioner.
HIGH DIFFICULTY	Preoperative condition is exceptionally complicated, exhibiting several factors listed in the MODERATE DIFFICULTY category or at least one in the HIGH DIFFICULTY category. Achieving a predictable treatment outcome will be challenging for even the most experienced practitioner with an extensive history of favorable outcomes.

Review your assessment of each case to determine the level of difficulty. If the level of difficulty exceeds your experience and comfort, you might consider referral to an endodontist.

The contribution of the Canadian Academy of Endodontics and others to the development of this form is gratefully acknowledged.

The AAE Endodontic Case Difficulty Assessment Form is designed to aid the practitioner in determining appropriate case disposition. The American Association of Endodontists neither expressly nor implicitly warrants any positive results associated with the use of this form. This form may be reproduced but may not be amended or altered in any way.

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## AAE Endodontic Case Difficulty Assessment Form

CRITERIA AND SUBCRITERIA	MINIMAL DIFFICULTY	MODERATE DIFFICULTY	HIGH DIFFICULTY
<b>A. PATIENT CONSIDERATIONS</b>			
<b>MEDICAL HISTORY</b>	<input type="checkbox"/> No medical problem (ASA Class 1*)	<input type="checkbox"/> One or more medical problems (ASA Class 2*)	<input type="checkbox"/> Complex medical history/serious illness/disability (ASA Classes 3-5*)
<b>ANESTHESIA</b>	<input type="checkbox"/> No history of anesthesia problems	<input type="checkbox"/> Vasoconstrictor intolerance	<input type="checkbox"/> Difficulty achieving anesthesia
<b>PATIENT DISPOSITION</b>	<input type="checkbox"/> Cooperative and compliant	<input type="checkbox"/> Anxious but cooperative	<input type="checkbox"/> Uncooperative
<b>ABILITY TO OPEN MOUTH</b>	<input type="checkbox"/> No limitation	<input type="checkbox"/> Slight limitation in opening	<input type="checkbox"/> Significant limitation in opening
<b>GAG REFLEX</b>	<input type="checkbox"/> None	<input type="checkbox"/> Gags occasionally with radiographs/treatment	<input type="checkbox"/> Extreme gag reflex which has compromised past dental care
<b>EMERGENCY CONDITION</b>	<input type="checkbox"/> Minimum pain or swelling	<input type="checkbox"/> Moderate pain or swelling	<input type="checkbox"/> Severe pain or swelling
<b>B. DIAGNOSTIC AND TREATMENT CONSIDERATIONS</b>			
<b>DIAGNOSIS</b>	<input type="checkbox"/> Signs and symptoms consistent with recognized pulpal and periapical conditions	<input type="checkbox"/> Extensive differential diagnosis of usual signs and symptoms required	<input type="checkbox"/> Confusing and complex signs and symptoms: difficult diagnosis <input type="checkbox"/> History of chronic oral/facial pain
<b>RADIOGRAPHIC DIFFICULTIES</b>	<input type="checkbox"/> Minimal difficulty obtaining/interpreting radiographs	<input type="checkbox"/> Moderate difficulty obtaining/interpreting radiographs (e.g., high floor of mouth, narrow or low palatal vault, presence of tori)	<input type="checkbox"/> Extreme difficulty obtaining/interpreting radiographs (e.g., superimposed anatomical structures)
<b>POSITION IN THE ARCH</b>	<input type="checkbox"/> Anterior/premolar <input type="checkbox"/> Slight inclination (<10°) <input type="checkbox"/> Slight rotation (<10°)	<input type="checkbox"/> 1st molar <input type="checkbox"/> Moderate inclination (10-30°) <input type="checkbox"/> Moderate rotation (10-30°)	<input type="checkbox"/> 2nd or 3rd molar <input type="checkbox"/> Extreme inclination (>30°) <input type="checkbox"/> Extreme rotation (>30°)
<b>TOOTH ISOLATION</b>	<input type="checkbox"/> Routine rubber dam placement	<input type="checkbox"/> Simple pretreatment modification required for rubber dam isolation	<input type="checkbox"/> Extensive pretreatment modification required for rubber dam isolation
<b>MORPHOLOGIC ABERRATIONS OF CROWN</b>	<input type="checkbox"/> Normal original crown morphology	<input type="checkbox"/> Full coverage restoration <input type="checkbox"/> Porcelain restoration <input type="checkbox"/> Bridge abutment <input type="checkbox"/> Moderate deviation from normal tooth/root form (e.g., taurodontism, microdens) <input type="checkbox"/> Teeth with extensive coronal destruction	<input type="checkbox"/> Restoration does not reflect original anatomy/alignment <input type="checkbox"/> Significant deviation from normal tooth/root form (e.g., fusion, dens in dente)
<b>CANAL AND ROOT MORPHOLOGY</b>	<input type="checkbox"/> Slight or no curvature (<10°) <input type="checkbox"/> Closed apex (<1 mm in diameter)	<input type="checkbox"/> Moderate curvature (10-30°) <input type="checkbox"/> Crown axis differs moderately from root axis. Apical opening 1-1.5 mm in diameter	<input type="checkbox"/> Extreme curvature (>30°) or S-shaped curve <input type="checkbox"/> Mandibular premolar or anterior with 2 roots <input type="checkbox"/> Maxillary premolar with 3 roots <input type="checkbox"/> Canal divides in the middle or apical third <input type="checkbox"/> Very long tooth (>25 mm) <input type="checkbox"/> Open apex (>1.5 mm in diameter)
<b>RADIOGRAPHIC APPEARANCE OF CANAL(S)</b>	<input type="checkbox"/> Canal(s) visible and not reduced in size	<input type="checkbox"/> Canal(s) and chamber visible but reduced in size <input type="checkbox"/> Pulp stones	<input type="checkbox"/> Indistinct canal path <input type="checkbox"/> Canal(s) not visible
<b>RESORPTION</b>	<input type="checkbox"/> No resorption evident	<input type="checkbox"/> Minimal apical resorption	<input type="checkbox"/> Extensive apical resorption <input type="checkbox"/> Internal resorption <input type="checkbox"/> External resorption
<b>C. ADDITIONAL CONSIDERATIONS</b>			
<b>TRAUMA HISTORY</b>	<input type="checkbox"/> Uncomplicated crown fracture of mature or immature teeth	<input type="checkbox"/> Complicated crown fracture of mature teeth <input type="checkbox"/> Subluxation	<input type="checkbox"/> Complicated crown fracture of immature teeth <input type="checkbox"/> Horizontal root fracture <input type="checkbox"/> Alveolar fracture <input type="checkbox"/> Intrusive, extrusive or lateral luxation <input type="checkbox"/> Avulsion
<b>ENDODONTIC TREATMENT HISTORY</b>	<input type="checkbox"/> No previous treatment	<input type="checkbox"/> Previous access without complications	<input type="checkbox"/> Previous access with complications (e.g., perforation, non-negotiated canal, ledge, separated instrument) <input type="checkbox"/> Previous surgical or nonsurgical endodontic treatment completed
<b>PERIODONTAL-ENDODONTIC CONDITION</b>	<input type="checkbox"/> None or mild periodontal disease	<input type="checkbox"/> Concurrent moderate periodontal disease	<input type="checkbox"/> Concurrent severe periodontal disease <input type="checkbox"/> Cracked teeth with periodontal complications <input type="checkbox"/> Combined endodontic/periodontic lesion <input type="checkbox"/> Root amputation prior to endodontic treatment

\*American Society of Anesthesiologists (ASA) Classification System

Class 1: No systemic illness. Patient healthy.  
 Class 2: Patient with mild degree of systemic illness, but without functional restrictions, e.g., well-controlled hypertension.  
 Class 3: Patient with severe degree of systemic illness which limits activities, but does not immobilize the patient.

Class 4: Patient with severe systemic illness that immobilizes and is sometimes life threatening.  
 Class 5: Patient will not survive more than 24 hours whether or not surgical intervention takes place.

[www.asahq.org/clinical/physicalstatus.htm](http://www.asahq.org/clinical/physicalstatus.htm)

• **Fig. 6.1 A and B**, Case difficulty classification by the American Association of Endodontists. (Published with permission from the AAE.)

## Advanced Dental Education Programs in Endodontics

Endodontics is one of the nine specialties recognized by the ADA. Specialty recognition is currently in a state of flux in the United States. To reduce potential bias and conflict of interest in the recognition process, the ADA recently supported the formation of an independent specialty recognition body, the National Commission on Recognition of Dental Specialties. Another independent specialty recognition board, the American Board of Dental Specialties, was also recently formed and recognizes four dental specialties that are not currently recognized by the ADA. Ultimately, it is under the purview of each individual state to determine which dental specialties to recognize.

Specialty recognition is separate from the actual accreditation of an advanced dental education training program. Advanced dental education programs in endodontics are accredited by the Commission on Dental Accreditation (CODA) and have specific and rigorous clinical, didactic, research, and teaching requirements. Programs are between 2 and 3 years in length, with a minimum of 24 months. Completion of a CODA-approved program in endodontics is required to announce specialty status in endodontics.

## Communication Between Endodontists and General Dentists

According to the most recent ADA summary of dental services in 2005 to 2006,<sup>5</sup> there were 22.3 million endodontic procedures carried out, with general dentists performing 68.2% and endodontists accounting for 25.4% (the remainder carried out by other specialists). These trends are little changed from the ADA 1999<sup>6</sup> study, which reported 75.2% and 20.3%, respectively. Most endodontic procedures are performed by general dentists, and for optimal patient care it is important to have a good communication between the generalist and specialist. This partnership is essential in helping patients save their teeth.

Communication between general dentists and specialists takes place in the context of the referral of urgent or complex cases, discussion of an optimal treatment plan for a patient, and/or discussion of the latest evidence for a particular procedure or material used in endodontic treatment. Many endodontists also endeavor to speak at local study clubs or regional meetings to promote information on the latest technologies and practices in the field. Most interactions occur by printed forms or letters that are given to the patient (for subsequent delivery) or sent by mail. Phone communication is a common and secure means to efficiently exchange ideas and information about the patient. Electronic forms of communication have become very common. However, many popular methods of electronic communication, such as e-mail, text messages, and online portals, are not inherently secure. Some e-mail programs permit encryption, which must be used for communication related to patients. Some practice management software programs offer online sites where information can be uploaded and viewed in a secure manner. According to the Health Insurance Portability and Accountability Act (HIPAA), there are 19 information items that constitute protected health information (PHI), which can be used to potentially identify a patient. These include the name, birth date, contact information, and health record number, among other items, and they must be kept secure to comply with the law.

## What Is Expected of a General Practitioner

Woodmansey and colleagues<sup>7</sup> found through an online survey of 40 predoctoral program directors at U.S. and Canadian dental schools that the average predoctoral student completed an average of 5.9 root canal procedures on live patients, and only 36% of the directors felt that their graduates were competent to perform molar root canals in private practice. By contrast most postgraduate endodontic programs in the United States run about 2 to 3 years. Gulabivala and coworkers (2010)<sup>8</sup> wrote a position paper published by the European Society of Endodontology stating that the minimal clinical requirement should be at 60% of the time, with a minimal number of 180 clinical cases completed.

Burry (2016)<sup>9</sup> looked at a very large database from insurance companies for up to 10 years for treatment completed by endodontists and general dentists, and the data indicated that there is no statistically significant difference in success and failure for incisors, canines, and premolars at 10 years. For molar teeth, however, the results were statistically significant at 10 years, with better outcomes for teeth in treatments performed by endodontists. This data is borne out in private practice as well, with studies showing that molars are the teeth most commonly referred to the endodontist.

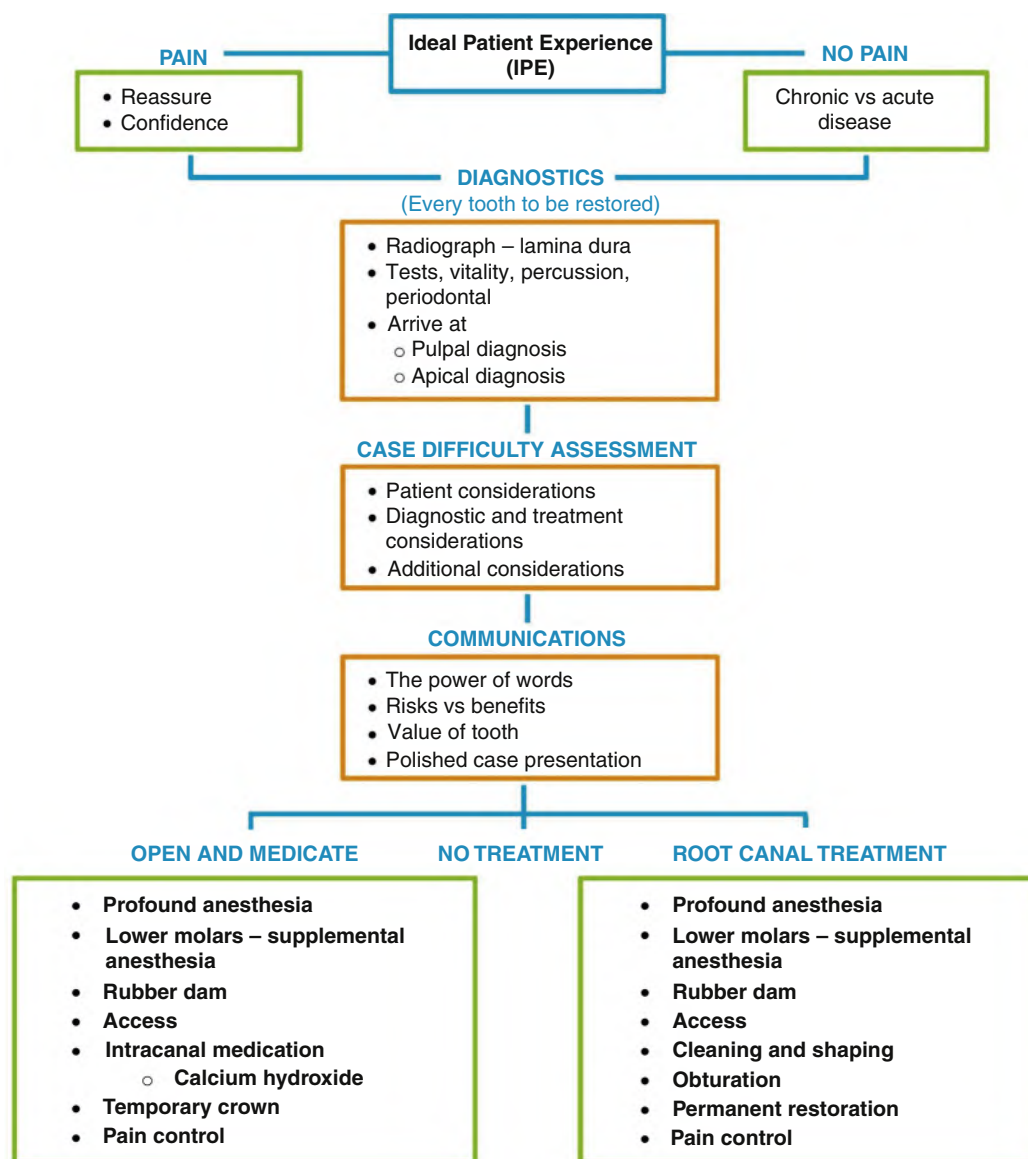
Clearly this is a challenging gap and therein exists a potential opportunity for better relationships between the specialist and general dentist.

Abbott and colleagues<sup>10</sup> surveyed general dentists to assess their perceptions and understand the factors associated with referrals to endodontists. A total of 983 general dentists responded; 93% agreed that “endodontists are my partners for delivering quality dental care.” In that study, the highest percentage of general dentists (96%) rated communications in the form of timely follow-up reports and images as the best ways to build relationships/partnerships, followed by referring the patient back for restorative treatment (94%) and patient scheduling accommodation (92%). Conversely only 38% mentioned that signs of appreciation, such as gifts, were an effective way to build a lasting relationship. This study reconfirms the importance of communications.

Explicit written instructions, pertinent findings, treatment history, and appropriate radiographs (original or duplicate) are mailed or sent via secure e-mail or website link to the endodontist. (Asking the patient to hand-carry these materials is discouraged.) These instructions should include how the tooth fits into the overall treatment plan, including the anticipated restoration.

## What Is Expected of an Endodontist

Lin and colleagues<sup>11</sup> looked at the relationship between the endodontists and their referrals. They looked at many different factors related to the economics of endodontics and referral base. A total of 875 endodontists responded to the survey. In terms of marketing, the majority of participants reported providing gifts (77.8%), personally visiting general dentist offices (76.0%), having websites (66.8%), and organizing social activities (51.9%). Some participated in local study clubs (39.7%) or had their business in the Yellow Pages (29.9%) or on Facebook (19.4%). Seven percent of participants reported having mobile app presences. Also, of interest here was the fact that the most commonly referred tooth type was maxillary molar (60.2%), followed by mandibular molar (38.8%). Almost 10% of the referral cases were referred after a procedural mishap. Almost 50% of the endodontists had performed some form of regenerative procedure.



• **Fig. 6.2** Ideal steps in diagnosis, case difficulty assessment, communication with the patient, and treatment.

Specialists serve both the patient and referring dentist, and their responsibilities are to both. They should deliver appropriate treatment and communicate with the practitioner and the patient. When treatment is complete, the referring dentist should receive written confirmation from the endodontist that includes a radiograph of the obturation. A note is included about how the tooth was treated, anticipated recalls, the prognosis (both short term and long term), and unusual findings or circumstances. A suggestion regarding the definitive restoration is appropriate. Before and during treatment, the endodontist explains to the patient all the important aspects of the procedure and the anticipated outcome. After completion of treatment, the patient is informed of the prognosis, appropriate follow-up care, and any possible additional procedures in the future, as well as the need to return to the referring dentist for definitive restoration and continued care.<sup>12</sup>

Based on these findings, two main points become clear. First, there is a disparity in predoctoral dental education, and second,

the general dentist has great confidence and belief in the partnership with the endodontist. As the pendulum shifts back to the maintenance of a healthy dentition related to our increased awareness of peri-implantitis, the generalist and specialist have a great opportunity to work together for the benefit of our patients.

Many endodontists are educators at heart, having taught in the undergraduate endodontic clinics, and are passionate about their craft. One of the best ways to nurture this relationship is through education and continuing education (CE) courses to develop the deep relationships that would strengthen and solidify these bridges and ultimately lead to a better patient experience. Fig. 6.2 shows the outline of a CE program that has worked well for one of the authors. There are many other topics, such as dental trauma, regenerative procedures, and cone beam computed tomography (CBCT), that are common areas of interest and will help with the synergistic relationship that will ultimately lead to better patient outcomes.



## Standard of Care and Endodontic Case Documentation

Based on reports by the AAE, approximately 75% of nonsurgical root canal procedures are performed by general dentists, and 25% are performed by endodontists (endodontists perform 62% of molar root canals and the majority of retreatment root canal and endodontic microsurgery procedures).<sup>13</sup> Although case selection plays a significant role in these percentages, it is important to recognize that there is one uniform standard of care for providing endodontic treatment regardless of whether the procedures are performed by general dentists or endodontists. Case selection is made based on proper diagnosis, factors that affect long-term prognosis, and complexity of the case being considered. Each practitioner should be fully aware of his or her technical skills and levels of knowledge to determine which cases to treat and which to refer. The AAE has developed a Case Difficulty Assessment Form (see Fig. 6.1) that can be used to assist dentists in assessing the level of difficulty when treatment planning a tooth for endodontic procedures.

Once the decision is made to plan an endodontic procedure treatment of a tooth, the procedural steps and quality of services provided must adhere to the same standards, regardless of who provides the treatment. These steps include obtaining informed consent based on assessment of patient history, chief complaint, clinical and radiographic examination, diagnosis of pulpal and periapical status, and clear presentation of the treatment plan, which includes prognosis as well as risks, benefits, and alternatives. Accurate record keeping is paramount in documenting that the patient has been advised of his or her condition and understands the treatment recommended, including associated risks and costs. Accurate record keeping is also important to memorialize the examination procedures that were used, as well as specific materials employed during treatment. When performing the procedures, if a general dentist encounters challenges that could jeopardize the outcome or create procedural accidents, a consultation with a specialist is advisable.

Proper diagnosis and pretreatment assessment of long-term prognosis depend on accurate and complete gathering of relevant information. Diligent review of the patient's medical history and chief complaint provide an initial impression that can serve as guidance for next steps required to confirm a diagnosis. Even the best treatment based on the wrong diagnosis will predispose the clinician and patient to frustration and an unfavorable treatment outcome. In fact, no treatment is better than rendering the wrong treatment, regardless of how inclined the clinician is to perform services to help a patient in need. The next steps include employment of proper diagnostic tests and obtaining diagnostic radiographs.

The clinical tests currently available simply evaluate the response of an individual to a given stimulus. Thus control teeth are necessary to understand a normal response for the individual patient. For instance, some patients may have extreme sensitivity to cold with all dentition. Evaluation of a single tooth may yield a false impression of an elevated response indicating pulpitis. On the other hand, some individuals do not exhibit a response to stimulus from any teeth. In this case lack of response to a stimulus in the suspected tooth alone may falsely indicate pulpal necrosis. Inclusion of control teeth will help establish normal responses to pulp testing in unaffected teeth before testing the suspected tooth.

A complete radiographic evaluation requires multiple angulations when using intraoral radiographic images to 3-dimensionally visualize a single tooth with multiple roots, presence of severe dilacerations, or multiple canals in a single root. Further, more information can be gathered from multiple views. The

radiographic image must capture the whole root and periapical structures, including the entire extent of an apical lesion when present. If apices are not clearly visible, additional images are required. All images obtained must be kept in the records regardless of quality because each angle can provide potentially beneficial information and because records must show all radiographs obtained. Bitewing radiographs allow visualization of bone levels in relation to existing restorations or caries, as well as visualization of the depth of the pulp chamber.<sup>14</sup> When challenges are encountered visualizing pathologic findings (e.g., incipient periapical lesions) to diagnose fractures or to determine proximity of certain anatomic structures, CBCT scans may be indicated.<sup>15</sup> Again, accurate documentation and recording of the preoperative test results are required for future reference.

The ultimate long-term prognosis of a tooth may be determined by other factors, such as periodontal status and restorability of the tooth in question. Measurement of periodontal attachment loss is critical in determining the correct diagnosis, which will ultimately dictate whether a tooth is likely to respond to endodontic treatment. Restorability may often require removal of existing restorations and caries to assess fully the remaining sound tooth structure. Patients must be informed of these considerations before initiation of treatment. Completion of endodontic treatment on an unrestorable tooth is as unethical as extraction of a sound tooth.<sup>14</sup>

Once a definitive diagnosis is made and the patient has consented to begin treatment, endodontic procedures performed must adhere to the accepted standard of care. These steps include the following:

**Proper and profound anesthesia.** Although this topic is covered in detail in Chapter 8, it is important to point out that most patients who express anxiety with regard to root canal therapy (RCT) have concerns about pain during the procedure. Profound anesthesia will provide a more pleasant experience for patient and clinician and will allow greater attention to performing the procedure properly.

**Adequate rubber dam isolation.** The primary goals of nonsurgical root canal treatment are to remove microbial contamination and to provide an adequate seal to prevent reinfection of the root canal system. To adhere to strict aseptic protocols, proper rubber dam isolation is necessary to prevent salivary contamination of the field of operation and to prevent aspiration of instruments, irrigants, or other materials. In short, tooth isolation using a rubber dam is standard of care and mandatory.<sup>16</sup>

**Proper biomechanical débridement.** Biomechanical débridement relies on the use of endodontic files to remove debris and to enlarge the canal space, allowing penetration of irrigating solution. Although canal enlargement should be adequate to allow passive insertion of a small-gauge needle, care must be taken not to overinstrument the canals at the expense of dentinal walls (no less than 1 mm). Proper working length determination early in the procedure is essential to minimize occurrences of overextension of material or creation of procedural mishaps, such as ledge formation or strip perforations.<sup>13</sup>

**Use of approved materials.** Mechanical instrumentation alone does not allow for optimum disinfection of the root canal system, and irrigation solutions with antimicrobial activity are required during canal débridement. Although sodium hypochlorite in various concentrations remains the most popular root canal irrigant, many new irrigation solutions have entered the market with various properties, including antimicrobial activity and/or smear layer removal activity. Because many of these irrigants can cause some

degree of irritation to the periapical tissues, care must be taken to avoid inadvertent extrusion of the solution beyond the root apex, which may occur by locking the needle in the canal space.

Most obturation systems include a solid core used in conjunction with a sealer. Proper canal instrumentation and competency in techniques employed for placement of these materials is essential to prevent overextension of the materials beyond the root apex. Although relatively biocompatible, most root canal filling materials can cause irritation because the immune system in the periapical tissues may recognize these materials as foreign. Paste fillers generally are not recommended because they are more difficult to control during obturation. Further, paste fillers containing paraformaldehyde must be completely avoided.<sup>17</sup>

**Adequate final restoration.** After completion of endodontic treatment, proper coronal restoration is critical to prevent reinfection of the root canal system and protect the tooth. Studies have shown that properly instrumented and filled root canals can become rapidly contaminated if not properly restored and exposure of gutta-percha and sealer to saliva can cause rapid penetration of bacteria.<sup>18-20</sup> Provisional restorations placed after the completion of endodontic procedures serve as a temporary seal and must be planned for replacement with a permanent restoration, preferably within 30 days. Exposure of provisional access restorations to saliva can cause recontamination of the root canal system within 30 days.<sup>21</sup>

**Proper postoperative care and instructions.** Postoperative instructions should be provided before and after treatment to help patients know what to expect in the ensuing days. These instructions should be provided in written form because patients often forget verbal information. Additionally, adequate perioperative medications should be provided as needed. More specific information regarding medications will be provided in Chapter 9.

### Study Questions

1. The ADA Code of Ethics position on duty to refer includes which of the following:
  - a. Being current on knowledge and skill
  - b. Knowing one's own limitations
  - c. Recognizing when to refer
  - d. All of the above
2. When performing root canal treatment, what is the difference in standard of care expected of a general dentist and an endodontist?
  - a. General dentists are held to a higher standard of care than endodontists
  - b. Endodontists are held to a higher standard of care than general dentists
  - c. General dentists and endodontists are held to the same standard of care
  - d. General dentists and endodontists are not held to a state but not national standard of care
3. How many years of additional training beyond dental school is required to become a specialist in endodontics?
  - a. A minimum of 12 months
  - b. A minimum of 22 months
  - c. A minimum of 24 months
  - d. A minimum of 36 months
4. To whom does the specialist have the primary responsibility?
  - a. Patient
  - b. Referring dentist
  - c. Patient's financial guarantor
  - d. No one
5. Who performs the majority of root canal procedures in the U.S.?
  - a. Endodontists
  - b. General dentists
  - c. Oral surgeons
  - d. Dental students

## Case Difficulty Assessment—When to Treat and When to Refer

The AAE has developed a form to assist with assessment of case difficulty and potential need for referral to a specialist, *AAE Endodontic Case Difficulty Assessment Form and Guidelines* (see Fig. 6.1). The form is a free download available at [https://www.aae.org/specialty/wp-content/uploads/sites/2/2019/02/19AAE\\_CaseDifficultyAssessmentForm.pdf](https://www.aae.org/specialty/wp-content/uploads/sites/2/2019/02/19AAE_CaseDifficultyAssessmentForm.pdf). The assessment form takes the user through a series of questions/conditions in three broad categories: patient considerations, diagnostic and treatment considerations, and additional considerations. Each of the three major categories is divided into subcategories.

The guidelines use the classifications titled minimal difficulty, moderate difficulty, and high difficulty to assist the practitioner in identifying the parameters of case difficulty and making a judgment as to whether the case is within his or her level of expertise. At first, the process may seem cumbersome. However, *repeated* usage and familiarity *reduces risk* for both patients and general dentists. This process should allow the dentist to provide optimum quality care. Referral can happen before, during, and after root canal treatment.

## Patient Considerations

### Medical History

Although some general dentists are well-trained in assessment and management of medically complex patients, especially clinicians who have completed a general practice residency (GPR) or Advanced Education in General Dentistry program (AEGD), a specialist is often better prepared to provide efficient RCT to a medically compromised patient. Frequently these patients are unable to stay in the dental chair for a long procedure, may require management under intravenous (IV) sedation or in the operating room, or require premedication and close monitoring during treatment. All these are factors that can complicate treatment, even if the technical aspects of the treatment do not appear to be complicated.

### Anesthesia

Although true allergy to an amide local anesthetic is considered rare,<sup>22</sup> a patient's previous experiences with local anesthesia may nonetheless require some form of treatment modification. A thorough dental history should identify patients who have had previous problems with local anesthesia; most commonly reported problems are sensitivity to a vasoconstrictor or difficulty achieving profound anesthesia. Both of these situations, individually and collectively, will elevate the degree of difficulty and can usually be determined with a good dental history.

### Patient Disposition

Anxious and uncooperative patients can present treatment challenges to both general dentists and specialists; however, the specialist's additional training and experience can often translate into a better patient experience or, at least, the ability to complete a procedure in a shorter period of time. Specialty training includes strategies for managing challenging patients.

### Gag Reflex and Ability to Open Mouth

Patients with an active gag reflex present difficulties in acquiring diagnostic quality radiographs, especially for posterior teeth, as

well as treatment. Alternatives such as a panoramic radiograph and/or CBCT imaging can often provide valuable additional information but should not be routinely used as a substitute for a high-quality periapical radiograph. Many patients with an active gag reflex often respond well to placement of a dental dam because the soft palate is then protected from stimulation, whereas other patients become claustrophobic and are not able to tolerate a dental dam. Oral anxiolytics or nitrous oxide/oxygen are sometimes useful, and there is a small subset of patients who will require general anesthesia for RCT. Because a dental dam is considered the standard of care for RCT, if it is not possible to place a dental dam, the patient is not a candidate for RCT.

Limited opening due to a variety of reasons can elevate the degree of difficulty from minimal to high.

### Emergency Condition

Patients presenting in severe pain and/or with significant swelling require a high level of skill and experience to manage (Fig. 6.3). Profound anesthesia is often difficult to obtain in the presence of infection and for teeth with a diagnosis of symptomatic irreversible pulpitis, especially mandibular posterior teeth.



• **Fig. 6.3** A 17-year-old male presented on an emergency basis complaining of pain and swelling of the upper lip. The diagnosis was pulp necrosis with acute apical abscess and cellulitis. Obtaining profound local anesthesia in situations like this can be very difficult and painful for the patient due to the diffuse tissue edema.

## Diagnostic and Treatment Considerations

### Diagnosis

Appropriate treatment follows accurate diagnosis. Diagnostic difficulties include confusing test results, nonspecific or unusual patterns of pain from periradicular lesions of nonpulpal origin, endodontic or periodontal lesions, and resorption.

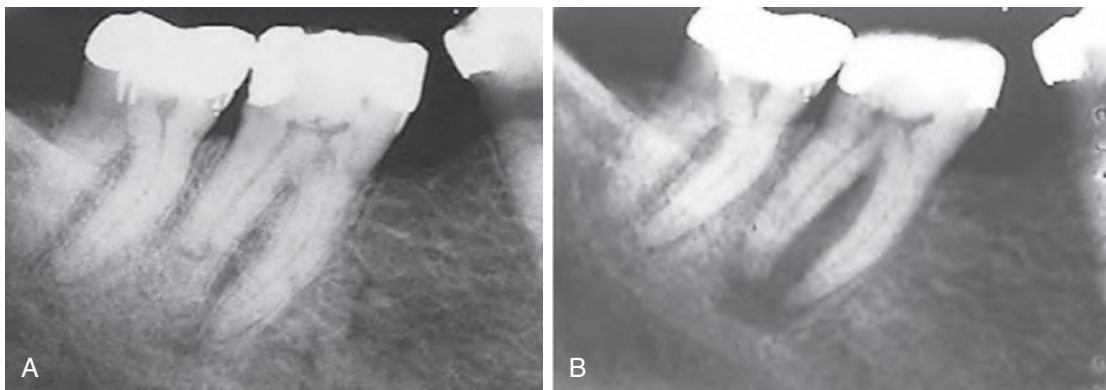
As noted in Chapter 4 the practitioner should be able to use the patient's signs and symptoms, the clinical and radiographic findings, and the results of clinical tests to establish a pulpal and periapical diagnosis and make treatment decisions accordingly. Applying these principles should allow the general practitioner to make an accurate diagnosis in most cases (Fig. 6.4). However, there are many cases in which the application of these basic principles is not sufficient, and the practitioner would need the expertise of a specialist to recognize and manage less common patient presentations or clinical conditions. These complex cases include situations in which diagnostic tests provide conflicting results or results that do not match the radiographic and clinical findings, traumatic injuries to teeth and their sequelae, diagnosis of symptomatic cases that were previously treated endodontically (Fig. 6.5), and/or orofacial pain or radiolucencies of nonendodontic origin that mimic endodontic pathosis.

### Radiographic Difficulties

Radiographs are important tools for proper diagnosis and treatment planning. In cases in which obtaining and interpreting radiographs are difficult, the patient should be referred to an endodontist. This circumstance occurs with patients who have muscle trismus, have received radiation therapy to the orofacial musculature, have severe gagging issues, and/or have a small oral cavity.

### Position in the Arch

Many dentists perform root canal treatment based on the location of the tooth in the arch. However, many other factors in addition to the location of the tooth in the arch make root canal treatment difficult. Depending on these factors, performing a root canal in a second molar in one patient may be easier than performing the procedure on a premolar in another patient.



• **Fig. 6.4** An Example of Simple Diagnosis. Tooth #30 had caries and was not responsive to pulp testing. **A**, The dentist excavated the restoration and placed a temporary restoration because “the tooth did not have a pulp exposure.” **B**, Three months later, a periapical lesion had developed. Endodontic treatment should have been initiated at the time of diagnosis for pulp necrosis.





• **Fig. 6.5** An Example of Complex Diagnosis. The patient had a chronic, dull ache in the mandibular left quadrant. Endodontic treatment had been completed 2 years earlier by an endodontist, and the lesion appeared to be resolving. The chief complaint could not be reproduced, and the radiographic pattern of the bone suggested a possibility of bone pathosis. The case was diagnosed by an oral and maxillofacial surgeon as chronic sclerosing osteomyelitis.



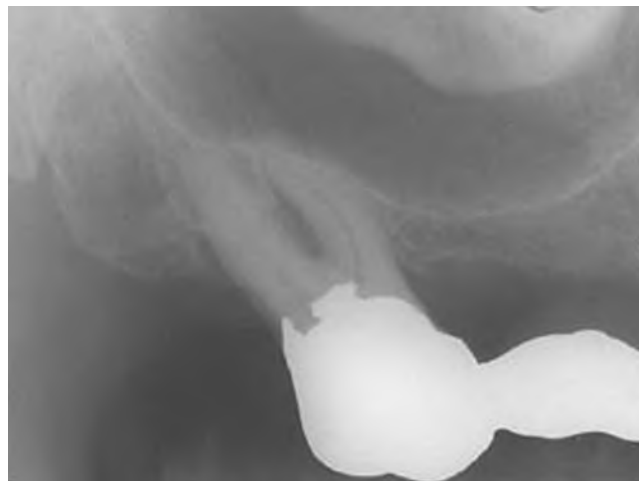
• **Fig. 6.6** In addition to the position of tooth #18 in the arch, this tooth will be challenging to isolate if retreatment root canal therapy (RCT) is indicated and has questionable restorability.

## Tooth Isolation

Because of severe caries or crown fractures, a tooth may be too difficult to isolate or to restore; extraction may be the best alternative. In some instances, crown lengthening may be necessary to create biologic width before performing root canal treatment. Referral to a specialist for this type of treatment should be considered if such a problem exists (Fig. 6.6).

## Crown Morphology

A number of anatomic factors should be considered in the treatment planning for a tooth intended for RCT. Many teeth that require root canal treatment have cast restorations. The restoration anatomy usually does not correspond to the original crown anatomy, and the pulp chamber can be difficult to locate. When a tooth that requires root canal treatment is part of a bridge, the angulation of the restoration to the original crown (Fig. 6.7), and



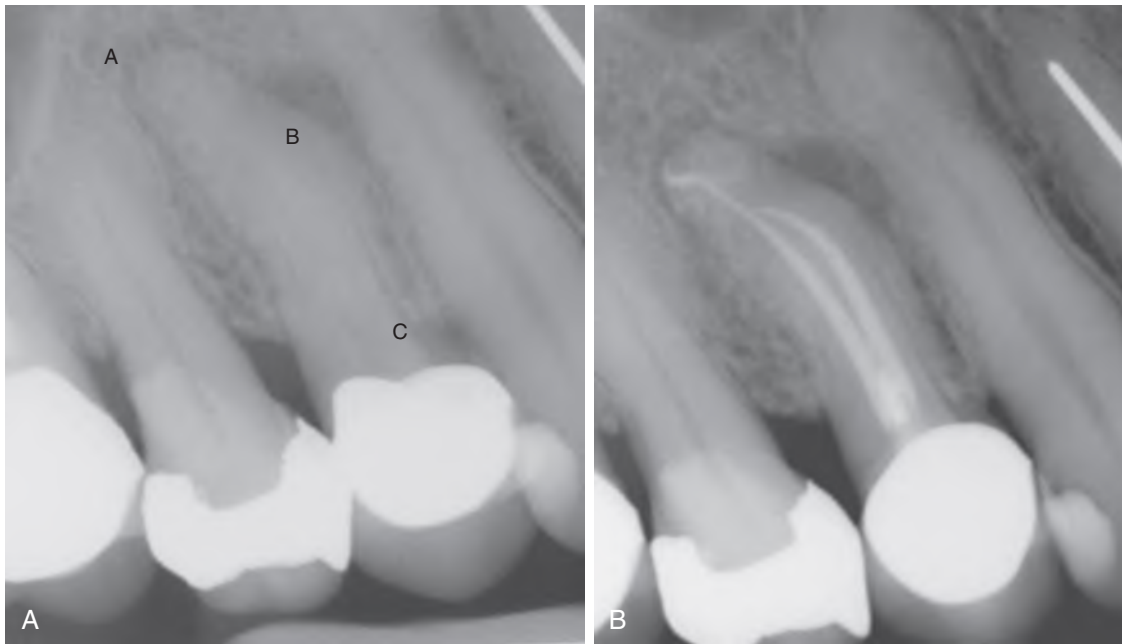
• **Fig. 6.7** This maxillary right second molar presents many challenges for endodontic therapy. It is mesially inclined about 45 degrees, has a full occlusal coverage restoration (abutment for a long-span fixed prosthesis), and moderately calcified canals. The degree of difficulty is high and would be even higher if the patient had limited ability to open.

its location in the arch must be examined carefully before an access preparation is made. These considerations are particularly important in maxillary first premolars, lateral incisors, and mandibular incisors. These teeth are narrow and prone to crown or root perforations during access cavity preparations. Access through gold is easier than access through nonprecious metals. Porcelain crowns are fragile and can break during access preparation. Newer zirconia-type crowns are very hard and often require special burs for access. When the pulp chamber and orifices to the root canals are not visible in the preoperative radiographs, referral to an endodontist should be considered (Fig. 6.8).

## Canal and Root Morphology

Several situations may limit access to the tooth in question, making it difficult to render routine treatment. These cases include limited mouth opening (particularly for the treatment of molars), tooth crowding, severe tilting or rotation, subgingival carious lesions necessitating crown lengthening or other procedures to ensure good isolation, and molars with very long working lengths. In the latter case, although the tooth may be accessible for routine restorative work, the use of long instruments to instrument the canals presents a challenge (Fig. 6.9).

There are a number of anatomic variations that may necessitate referral to an endodontist. These include teeth with an immature apex, teeth with severe canal curvature (Fig. 6.10, *A and B*), or teeth with a very calcified canal space. The general dentist should always be aware of the common anatomic variations of teeth and should rely on consultation or referral if he or she suspects additional canals that cannot be located, if the anatomic variation is unusual, or if the disease process persists despite treatment. Examples of circumstances in which the anatomic variations may render a case difficult to manage by the general dentist include mandibular premolars with more than one canal; maxillary premolars with more than two canals; radix entomolaris (extra roots in the mandibular molars); C-shaped canals (Fig. 6.11); dens invaginatus and evaginatus; fused and geminated teeth; teeth with palatal groove defects; and teeth with lateral or J-shaped lesions (which may have unusual canal branching).



• **Fig. 6.8** **A**, Periapical radiolucency (**A**) and mesial radiolucency in the apical third (**B**). The canals are calcified, the root is narrow, and there is a hint of a significant mesial concavity in the coronal third (**C**). The tooth is also crowned, thereby increasing access complexity. This case is considered a high risk. **B**, Post-operatively, the mesial radiolucency resulted from the buccal root exiting several millimeters shorter than the palatal root with a significant distal curvature. The practitioner must manage unexpected complications should problems arise during treatment.



• **Fig. 6.9** Maxillary left second molar with working lengths that ranged from 26 to 28 mm.

### Radiographic Appearance of Canal(s)

As a tooth ages, its pulp chamber and root canals calcify. Pulp chamber and root canal sizes, the presence of pulp stones, and the extent of calcifications in the root canal system must be considered before a decision is made regarding root canal treatment (Fig. 6.12). Management of these teeth is always challenging and typically requires use of a dental operating microscope and often CBCT imaging.

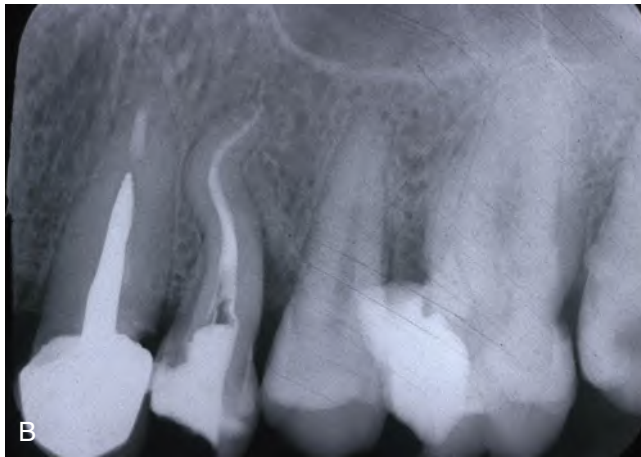
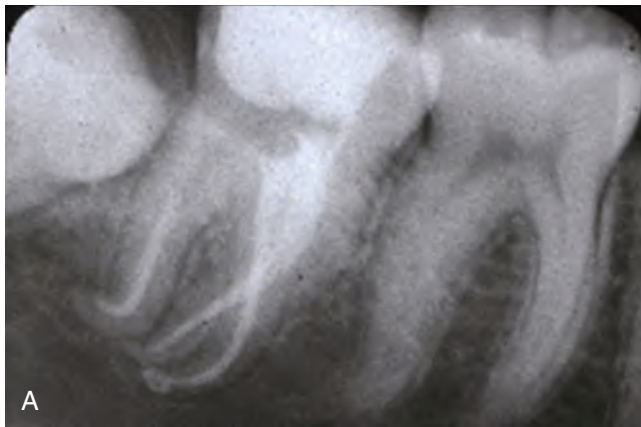
### Resorption

Apical root resorption, common in necrotic teeth with long-standing apical periodontitis, requires careful determination and control of proper working length to help prevent overextension of root filling materials. Internal and external resorption (invasive

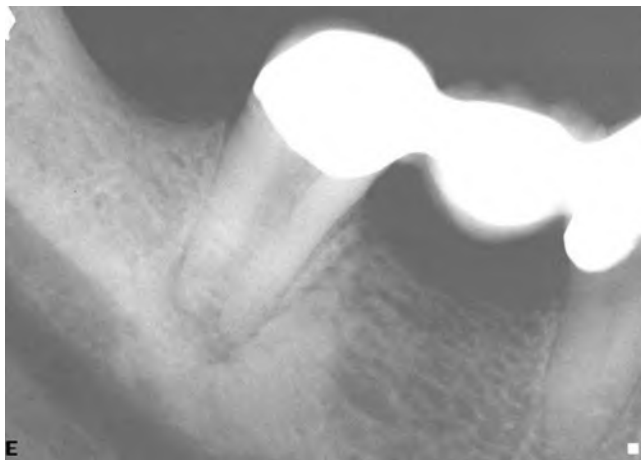
cervical resorption) are two separate conditions, and both require a high level of diagnostic and treatment skill (Figs. 6.13, *A* and *B*).

### Additional Considerations

Many of the cases that fall into the categories of traumatic injuries, retreatments, and surgeries are further described in the corresponding chapters (Chapters 11, 19, and 20, respectively); a general description of the interaction of the general dentist and the specialist is given here. Many cases of traumatic injuries are first seen by the patient's general dentist. The general dentist has an obligation to manage the emergency condition and triage the patient appropriately. The latest guidelines for management of traumatic injuries should be readily available and frequently reviewed. Diagnosis should include the pulpal and periapical



• **Fig. 6.10** **A**, This mandibular right second molar exhibited extreme root curvatures and presented access and isolation difficulties (Case courtesy Dr. Steve Weeks). **B**, Immediate postoperative radiograph of maxillary left second premolar demonstrating “S” curvature.



• **Fig. 6.11** Mandibular right second molar with suspected S-shaped canal space. The location in the arch, moderate mesial inclination, and presence of full occlusal coverage restoration would add to the complexity of treatment.

conditions of all the teeth in the area of trauma after the necessary examination and clinical testing has been performed. Management includes first aid for soft tissue injuries, repositioning of luxated teeth, and/or restoration of fractured teeth. The specialist should be involved in the diagnosis and management of



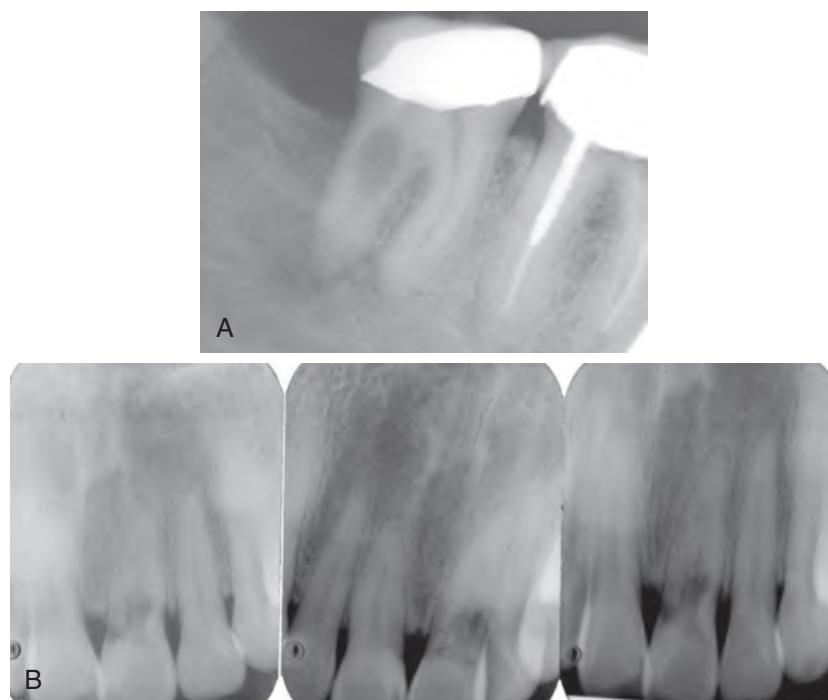
• **Fig. 6.12** Pulp chamber and root canals show calcific metamorphosis. This situation is rated as an extreme risk.

extensive injuries and complications, including luxations, fracture of the alveolar bone and obvious pulpal involvement, root fractures, root resorptions, teeth with immature apices, patients with behavioral or complex medical problems, and late complications of trauma.

The general dentist plays an important role as the gatekeeper of the patient's oral health in recognizing and referring cases with failure of previous endodontic treatment (**Fig. 6.14, A and B**). Many of these cases are asymptomatic; therefore recognizing them requires adequate clinical and radiographic examination of the patient (**Fig. 6.15, A and B**). The general dentist should be aware of the treatment procedures that are within the scope of endodontic practice and educate the patient accordingly. It is important that the general dentist present the patient with all the available treatment options before recommending that a tooth be extracted and replaced by an implant or prosthesis. There are many cases in which the general dentist recognizes that additional expertise in determining the prognosis and treatment options is needed and that consultation with an endodontist is warranted. In retrospect, many of the cases that are surgically or nonsurgically retreated by an endodontist should have been referred to the endodontist for primary treatment (**Fig. 6.16**). The prudent general dentist recognizes a case that is likely to be too complex and refers appropriately, rather than risk the development of treatment problems. There are many cases in which treatment appears to be routine, yet problems are encountered; referral to an endodontist can help ensure a good outcome.

## Referral During Treatment

The timing and discussion of referral with the patient are important during treatment planning. It is poor practice to initiate treatment with the sense that problems will be encountered and that a referral will be made then. An initial referral prevents potential procedural accidents and improves the prognosis of difficult cases. Midtreatment referral may also result in misunderstanding and loss of confidence by the patient. Another issue is financial problems that may arise during midtreatment referrals. The



• **Fig. 6.13** **A**, Large internal resorptive lesion observed in the distal root of the mandibular right second molar. **B**, Extensive invasive cervical resorption in maxillary left central incisor as seen in three angled radiographs. Cone beam computed tomography (CBCT) would be very useful to determine the extent of this lesion and develop a treatment plan.

endodontist is entitled to a full fee, and the patient should not be responsible for two fees for one tooth.

Despite all precautions and considerations, unanticipated problems may arise during treatments that require referral. A full explanation to the patient and a call to the endodontist are the necessary elements to prevent future problems. Reasons for referral during treatment include flare-ups (pain and/or swelling), procedural accidents, inability to achieve adequate anesthesia, and other factors that hinder completion of RCT.

### Flare-ups

Usually most pain or swelling occurs before initial treatment. After emergency treatments, pain usually decreases significantly in most patients within 24 to 48 hours. Flare-ups are not common during root canal treatments.<sup>23</sup> However, some patients develop pain and/or swelling after initiation of root canal treatment. The general dentist may elect to treat such flare-ups with appropriate local procedures and systemic medications. If these measures prove inadequate, referral to an endodontist is in order.

### Procedural Accidents

Procedural accidents during root canal treatment include ledge formation, creation of an artificial canal, root perforations, separated instruments, hypochlorite accidents, and underfilling and overfilling. (The causes, prevention, and prognosis of these mishaps are discussed in detail in [Chapter 18](#)) Consultation with an endodontist is advisable to handle these accidents nonsurgically or, in some cases, surgically (properly and expediently) with

appropriate follow-up. Treatment approaches and long-term assessment of these cases are usually beyond the expertise of a general dentist.

### Referral After Treatment

Persistent problems, such as pain, pathosis, and sinus tract after root canal treatment may indicate root canal failure and the need for further evaluation and treatment.

### Pain

If pain and/or swelling persist or develop after treatment, the patient should be referred, or an endodontist should be consulted. These symptoms may be related to lack of débridement, inadequate obturation, missed canals, root fractures, or other causes. Surgical and/or nonsurgical retreatment procedures or extraction might be in order.

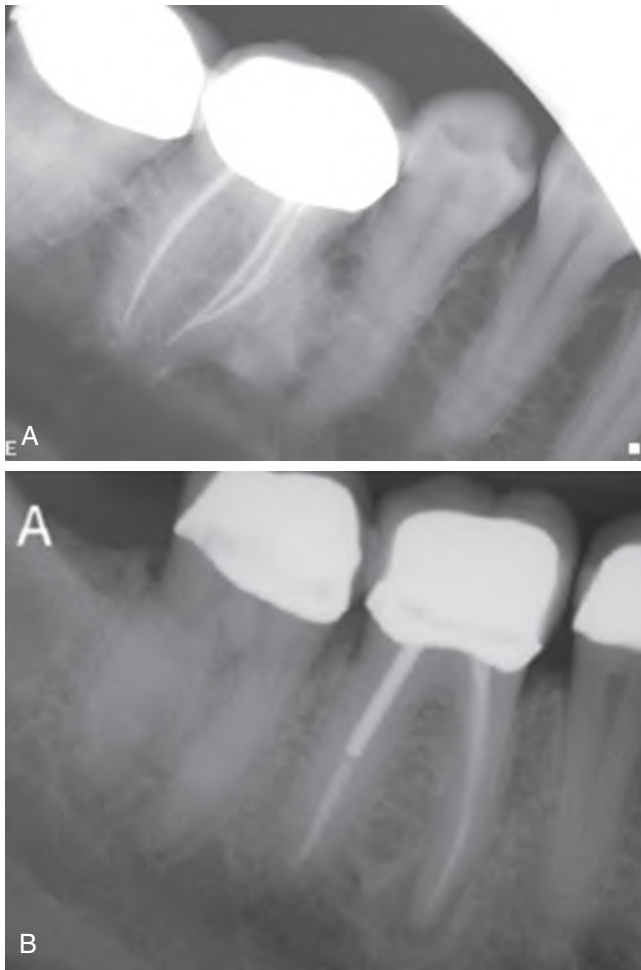
### Persistent Pathosis

Persistent periapical lesions or the development of new lesions after root canal treatment is indicative of root canal failure. Surgical and/or nonsurgical retreatment procedures are needed to resolve the problem.

### Sinus Tract

When a periodontal defect of pulpal origin or a sinus tract does not resolve after treatment, the patient should be referred to an endodontist. The presence of a new defect or sinus tract indicates treatment failure, and the patient must be referred for consultation or treatment by an endodontist.





• **Fig. 6.14** These are examples of previously treated teeth that present a high level of difficulty. **(A)** is a previously treated mandibular right first molar with carrier-based filling material; **(B)** has a post in the distal canal. This tooth could be managed either with nonsurgical retreatment or endodontic microsurgery, and both options could lead to a predictable outcome when managed by a specialist.

## Summary

Sometimes the most important treatment planning decision made by a general dentist is deciding when *not* to treat. Midtreatment referral to an endodontist to help manage a treatment complication creates unnecessary stress for all involved and can damage the patient–dentist relationship. A good endodontist will never disparage the work of a general dentist; however, most patients can sense when a general dentist has started treatment that might have been better managed by an initial referral to a specialist. Part of an endodontist’s skill set is managing treatment complications, but every endodontist will tell you they would rather be the first clinician to initiate treatment on a difficult case rather than attempt corrective action.

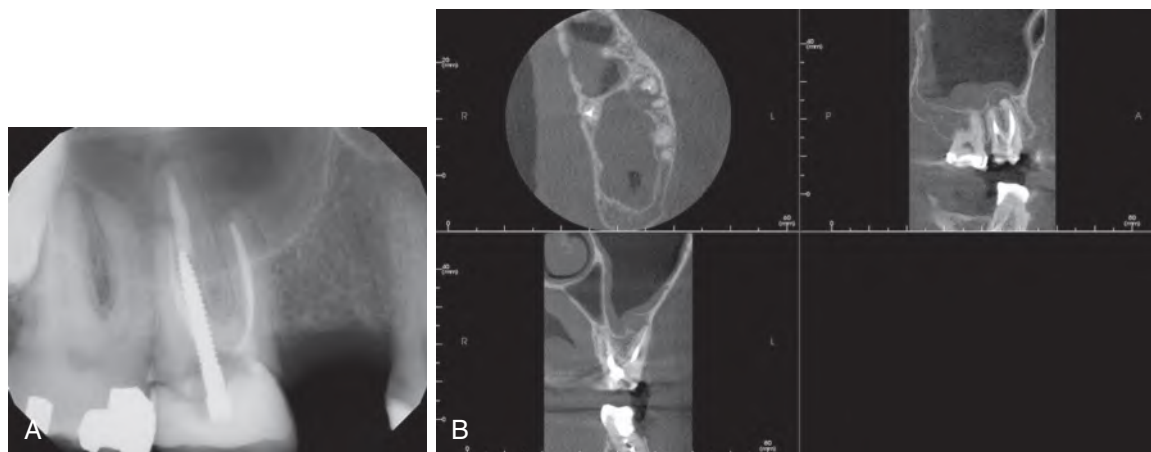
## Study Questions

6. Which of the following is a potential indication for referral to a specialist?
  - a. A patient’s report of difficulty with local anesthesia during previous dental procedures
  - b. Severely calcified canal
  - c. Challenges posed by location of a tooth in the arch
  - d. Teeth with incomplete root development
  - e. All of the above
7. Which of the following is the proper method of tooth isolation for endodontic therapy in patients with a severe gag reflex or claustrophobia?
  - a. Cotton role and gauze
  - b. Rubber dam
  - c. Use of high-volume suction and mirror
  - d. None of the above
8. The general dentist plays an important role in which of the following?
  - a. Management of traumatic injuries
  - b. Identifying failure of previous endodontic therapy
  - c. Identifying complex cases, which may require referral to the appropriate specialist
  - d. All of the above
9. What is the definition of a flare-up?
  - a. Patient is upset about cost of treatment
  - b. Pain to cold and heat
  - c. A cracked tooth
  - d. Pain and swelling after initiation of root canal therapy
10. Procedure accidents include all of the following except:
  - a. Instrument separation during root canal therapy
  - b. Perforation during access preparation
  - c. Root fracture due to traumatic injury
  - d. Hypochlorite accident

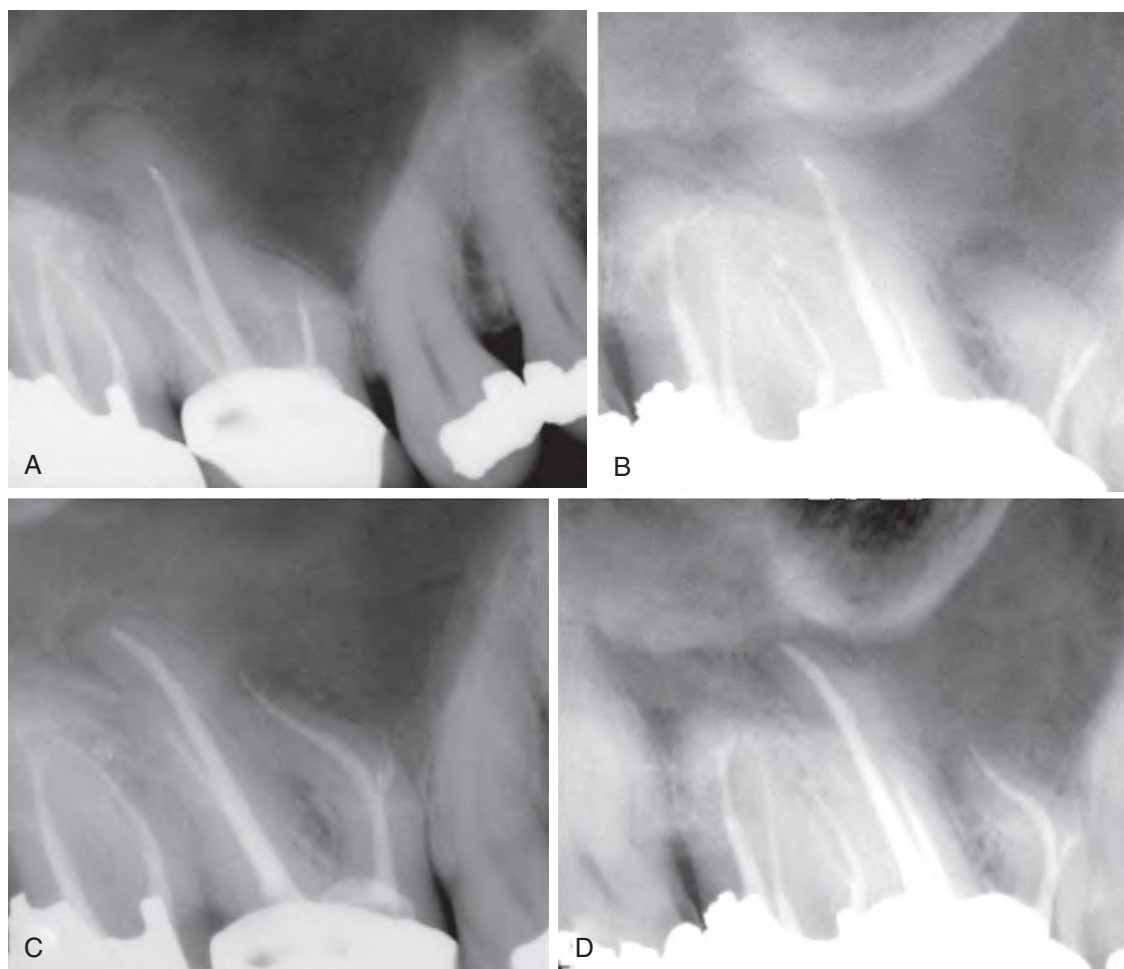
## ANSWERS

### Answer Box 6

- 1 One of dentist’s primary obligations is knowing his or her own limitations and when to refer to a specialist.
- 2 No difference
- 3 2 or 3 years (minimum 24 months)
- 4 False. Specialists serve both the patient and the referring dentist.
- 5 False. General dentists perform approximately 75% of root canal procedures, although endodontists perform 62% of molar RCT.
- 6 True
- 7 False. Use of a dental dam is the standard of care for root canal treatment, primarily to protect the patient from aspiration or ingestion of endodontic instruments and also to maintain proper asepsis. Inability to place a dental dam is an absolute contraindication to performing root canal treatment.
- 8 False
- 9 True
- 10 False. There are many other factors in addition to the location of the tooth in the arch that make root canal treatment difficult.



• **Fig. 6.15** This asymptomatic previously treated maxillary right first molar was referred to an endodontist to evaluate for possible retreatment or endodontic microsurgery before proceeding with a new crown. The standard two-dimensional image (**A**) was of limited value. However, cone beam computed tomography (CBCT) of the tooth demonstrated clear evidence of periapical pathosis and sinus mucositis secondary to persistent endodontic disease.



• **Fig. 6.16** Patient presented to the general dentist for root canal treatment of tooth #3. The tooth has severe curvature of mesial buccal (MB) root. The dentist performed root canal treatment and a crown for the tooth. **A**, Three months later, the patient was referred to the endodontist with continued pain. The straight radiograph shows that the MB canal could not be negotiated to length and had a possible perforation. There was blockage apically in the palatal (P) and distal buccal canals. The palatal root has a small radiolucency. **B**, Distal shift showing the perforation on the MB canal and the lesion related to this root. The root apex had apical root resorption. **C**, Retreatment was successful in negotiating the MB and P canals. Sealed the perforation with mineral trioxide aggregate (MTA). **D**, Six months follow-up showing healing of the lesions and absence of signs and symptoms of disease.

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