Assessing Endodontic Case Difficulty

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About the Author

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INTRODUCTION

Performing endodontic therapy can be stressful and unpredictable if a clinician attempts to treat a tooth that is beyond his or her comfort level. A careful examination of the preoperative radiograph can help clinicians decide if they feel comfortable performing root canal therapy on a particular tooth. The presence of a crown or large restoration, the number and shape of canals, and the position of the tooth in the mouth can all influence the degree of difficulty in performing endodontic therapy. This article will focus on identifying those factors that can complicate treatment.

The “Three Cs”

A simple way to prescreen for challenging teeth is to remember the “3 Cs” in case selection. Teeth with crowns, curves, or calcifications are more difficult to treat endodontically than teeth without any of these existing impediments. If a tooth has more than one “C,” then it is even more challenging.

The case seen in Figure 1 is one in which a maxillary anterior tooth has a crown. The canal appears to be somewhat thin in the radiograph. Locating this canal through an access opening in the crown will add an increased degree of difficulty to this case. Proper magnification, preferably with a dental operating microscope, is necessary to avoid perforation during access. It is also important to avoid unnecessary removal of tooth structure during access preparation. Minimally invasive endodontics (MIE) has been the topic of much debate.1,2 Access preparations need to be cut large enough to allow for the location of all canals, but a balance must be achieved to maintain sound tooth structure. If a clinician desires to preserve the existing crown, the delicate balance of MIE is even more critical. An access preparation that is cut too large to help a clinician locate a canal will leave a tooth with both compromised dentin and a compromised coronal restoration.

Figure 2 illustrates a case in which significant curves are present in the canals. This tooth required careful instrumentation to avoid ledging of the canals and instrument separation.

Calcification can be present in different forms. Canals can be thin or even appear nonexistent on a radiograph. Pulp chambers can be flat and narrow. Figure 3 shows a unique case in which a large calcified pulp stone blocked the coronal portion of an otherwise “easy” canal to instrument. Removal of the stone required the use of ultrasonics and the microscope to avoid perforation or excessive removal of tooth structure. If the clinician ignored the preoperative radiograph in a case like this,
he or she would be in for a big surprise. Even rotary files, such as orifice openers, will not go past pulp stones of this size nor remove them.

**Unusual Canal Morphology**

The 3 Cs of case selection is a simplified way for the general dentist to first approach the decision of whether to perform endodontic therapy or to refer the case to a specialist. Other factors can affect the degree of difficulty in performing endodontic therapy as well. A careful examination of a preoperative radiograph is imperative to identify possible anatomical variances that potentially could “surprise” the clinician upon access preparation into the pulp chamber.

Endodontic treatment is done in anterior teeth and premolars both by advanced clinicians and by those clinicians who prefer not to tackle molar therapy. While these teeth are often thought of as uncomplicated, they can exhibit rare and complex canal configurations. It cannot be emphasized enough that thorough inspection of preoperative radiographs is necessary, even when preparing to treat teeth that are assumed to be relatively easy. A few case examples of unusual canal anatomy will be discussed. Comparing the preoperative and postoperative radiographs in the following examples can help train the eye to know what to look for when anticipating possible surprises.

Maxillary anterior teeth are usually the least complicated teeth in the human dentition to treat endodontically. It is often assumed that these teeth have one canal. The maxillary lateral incisor shown in Figure 4 drives home a key point. Be extremely vigilant when analyzing preoperative radiographs. If something looks unusual on a radiograph, it probably will be unusual when the clinician enters inside the actual tooth. Nothing is ever anatomically guaranteed in endodontics. The maxillary lateral incisor presented in Figure 4 has more than one canal. The unusual appearance of the tooth on the preoperative radiograph is a key sign to expect the unexpected.

The maxillary first premolar is often thought of as containing 2 canals; a buccal and a palatal canal. It can have one canal, but it can even have 3 canals like a “mini-molar.” While it is more common to find a single canal in the maxillary second premolar, it is important to remember this tooth can have more than one canal as well. Figure 5 shows a case in which a maxillary second premolar had 2 canals.
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The tooth in Figure 5 illustrates an interesting key point that corroborates with the importance of studying the preoperative radiograph very carefully. In the preoperative radiograph (Figure 5a), notice how the canal begins in the coronal portion of the tooth and then seems to fade away. Sometimes this is mistaken for calcification, but most often, calcification begins in the coronal portion of a tooth and travels apically, not in reverse. When a canal presents with a thick coronal portion and then seems to fade out, it is often indicative of a canal splitting from one large common path into 2 (or more) thinner canals. The postoperative radiograph shows this to be the situation with tooth No. 13. One main canal branched into 2 at the mid-root level.

The mandibular premolars are usually considered to be teeth containing one canal, but they can have multiple canals similar to their maxillary counterparts. The tooth in Figure 6 illustrates a mandibular premolar with 2 canals. It also shows, once again, a situation in which the canal appears to fade away—this time at the mid-root level. In reality, the canal is dividing much like the case in Figure 5.

Mandibular premolars can have multiple canals. The tooth presented in Figure 7 shows an example of a mandibular premolar with 3 canals. Remember, you need to study the preoperative radiographs!

**Tooth Position**

Treating all the canals endodontically in a tooth is the ultimate goal of root canal therapy, but finding them without causing damage is paramount for successful longevity of the tooth. Tooth position and angulation is important to note before preparing an access preparation into the pulp chamber. Access should be made within the long axis of the tooth. If the tooth is severely tilted as in Figure 8, drilling "straight down" will lead to perforation. It cannot be emphasized enough to study the preoperative radiograph, but a tooth should also be evaluated clinically in the mouth to identify any complicating inclinations.

What if by accident, a perforation does occur? Perforations can be repaired with a variety of materials. If the perforation is above the gingival margin, composite resin (or any other restorative material of choice) can be used. When the perforation is into periodontal areas, a biocompatible material must be used. ProRoot Mineral Trioxide Aggregate (MTA [DENTSPLY Tulsa Dental Specialties]) is a highly biocompatible material with excellent long-term results.3-4 MTA is available in either gray or white formulas. Both types are prepared in similar ways. A powder component is mixed with water to create a paste. The MTA is placed in the perforation and compacted. It then is allowed to set and create a seal.

**Figures 6a and 6b.** Mandibular first premolar with 2 canals. (a) Pre-op radiograph. (b) Post-op radiograph.

**Figures 7a and 7b.** Mandibular second premolar with 3 canals. (a) Pre-op radiograph. (b) One-year follow-up radiograph displaying full-coverage restoration and normal periapical areas.

**Figures 8a and 8b.** Mandibular molar with severe mesial tilt. Access was made within the long axis of the tooth, not "straight down." (a) Pre-op radiograph. (b) Post-op radiograph.
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MTA has been the material of choice for perforation repair for nearly 2 decades. Although it is preferred over other materials due to its high biocompatibility, it does have the disadvantages of a long setting time and limited resistance to washout before setting. Biodentine (Septodont) has recently been developed to overcome these drawbacks. It is a fast-setting, calcium silicate-based restorative material with biocompatibility similar to that of MTA. Compared to MTA, Biodentine has a considerably shorter setting time and is easier to handle, making it a material worth considering when repairing perforations.

While on the topic of access preparation, the following is a very important tip regarding clinical note keeping. When writing treatment notes for an endodontic procedure, the status of the pulp should always be mentioned. Phrases like “inflamed pulp tissue removed,” “no vital tissue,” “purulent drainage observed,” etc, need to be in the chart. From a legal standpoint, this helps build support for why endodontic therapy was performed on the tooth. If the unfortunate situation arises that a patient accuses a clinician of treating the wrong tooth or performing an unnecessary procedure, the description of the status of the pulp helps in the defense. Failing to mention what was found when accessing the pulp chamber leaves an open window for an attorney.

CLOSING COMMENTS
Case selection is an important part of endodontic treatment. Careful evaluation of preoperative radiographs is a cornerstone of success. Aside from complexities due to tooth morphology and restorative obstructions, other factors can affect the degree of difficulty in performing endodontic therapy. The medical history of the patient and the surrounding circumstances necessitating treatment can also influence the level of difficulty. The American Association of Endodontists (AAE) has a free Case Difficulty Assessment Form available to download online at aae.org. This AAE Case Difficulty Assessment Form can help clinicians organize their thoughts and select cases that they can succeed at treating. It helps in the decision making process to avoid wasted chair time. It will make clinicians look like heroes to their patients by performing quality treatment.

If advanced case selection material is desired, there is more free information available from the AAE. On the website, an additional report entitled Treatment Options for the Compromised Tooth: A Decision Guide is also available for download. This advanced report delves into topics such as tooth fractures, endo-perio lesions, external resorption, and procedural complications.

In endodontic therapy, clinicians need to know what they are looking for before they go looking for it. The preoperative radiograph is often the map to success or the omen of difficulty.

References
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1. Minimally invasive endodontics has been the topic of much debate.
   a. True   b. False

2. Endodontic treatment in anterior teeth and premolars is often thought of as uncomplicated because these teeth rarely exhibit complex canal configurations.
   a. True   b. False

3. While it is more common to find a single canal in the maxillary second premolar, it is important to remember this tooth can have more than one canal as well.
   a. True   b. False

4. The mandibular premolars are usually considered to be teeth containing one canal, but they can have multiple canals, similar to their maxillary counterparts.
   a. True   b. False

5. Compared to mineral trioxide aggregate, Biodentine (Septodont) has a considerably longer setting time and is more difficult to handle.
   a. True   b. False
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Please check the correct box for each question below.

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2. ☐ a. True ☐ b. False
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4. ☐ a. True ☐ b. False
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