Perspectives on Endodontic Therapy and Instrumentation
A Peer-Reviewed Publication
Written by John C. Comisi, DDS, MAGD

Abstract
Endodontic treatment has as its overall goal the long-term retention and restoration of the endodontically treated tooth, including an absence of periradicular infection. For this to be achieved, a number of steps and a careful technique are required during instrumentation and irrigation for cleansing and shaping of the canals, and during root canal obturation.

Over time, root canal instrumentation options increased to include NiTi reamers and files, Gates Glidden drills, and other designs for manual and rotary use. Instrumentation options and techniques for obturation also increased to include traditional lateral and vertical cold condensation techniques, as well as techniques utilizing carriers of different designs and new materials. Regardless of which combination of instrumentation and techniques is used, successful endodontic therapy relies on a number of sequential steps that must be thoroughly carried out.

Learning Objectives:
The overall goal of this course is to provide the reader with an overview of root canal instrumentation and obturation techniques.

On completion of this course, the reader will be able to do the following:
1. List and describe the overall goal and objectives of endodontic treatment.
2. Define and describe endodontic instrumentation options.
3. Discuss the requirements for a root canal irrigant.
4. List and describe currently available root canal obturation techniques.

Author Profiles
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Dr. Comisi has been in private practice in Ithaca, NY since 1983. He is a graduate of Northwestern University Dental School and received his Bachelor of Science in Biology at Fordham University. He is a member of the American Dental Association and its tripartite organizations, the Academy of General Dentistry, the American Equilibration Society, the International and American Association of Dental Research, a Research Associate at New York University Dental School. Dr. Comisi is a Master of the Academy of General Dentistry, and holds fellowships in the Academy of Dentistry International, the American College of Dentistry, the Pierre Fauchard Academy and the International College of Dentistry.

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Abstract
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Over time, root canal instrumentation options developed to include NiTi reamers and files, Gates Glidden drills, and other designs for manual and rotary use. Instrumentation options and techniques for obturation also increased to include traditional lateral and vertical cold condensation techniques, as well as techniques utilizing carriers and new materials. Regardless of which combination of instrumentation and techniques is used, successful endodontic therapy relies on a number of sequential steps that must be thoroughly carried out.

Introduction
The landscape of the science of endodontics has evolved over the last few decades, and continues to do so. Initially, the science of endodontics was not fully understood, and incomplete or partial pulpotomies were considered the standard of care. As the science and evidence for endodontics developed, it was understood that, in cases of irreversible pulpsitis, pulpectomy was required to successfully treat these teeth. Endodontic treatment can involve nonsurgical or/and surgical treatment. For the purposes of this article, we will focus on nonsurgical treatment. As endodontic techniques developed, success rates increased. Current and recent treatment modalities have resulted in success rates of up to 98% where no apical periodontitis was present at the time of treatment; this, together with the ability to thoroughly prepare and fill the root canal system, is a primary factor in the success or failure of pulpectomies. Other factors include the type of restoration placed following endodontic treatment, with higher tooth retention and success rates generally found in crowned teeth compared to uncrowned teeth.

Endodontic Instrumentation
To begin nonsurgical endodontic treatment, one accesses the pulp chamber and root canals coronally using straight-line access. Endodontic instruments have been developed to include manual, mechanical, and ultrasonic instruments. Endodontic files and reamers of various types can be used to cleanse and shape the canals, with intermittent irrigation providing for disinfection and the removal of debris. Clinical proficiency is required to achieve these goals. Care must be taken during treatment to prevent blockage of the canal system, the creation of ledges or “pseudo” canals, and of course, perforation of the canal. Should any of these problems occur, they could ultimately lead to failure of the endodontically treated tooth.

To additionally complicate treatment, obstructions of the upper chamber of the root canal system can result from the presence of calcified structures and stones that can occur naturally as a physiological response to various challenges experienced by the tooth. Caries advancement, “conservative” dental treatment, aging of the tooth, occlusal forces, and parafunctional habits can all lead to this calcification process. Calcifications, as well as anastomoses
or isthmuses, and accessory canals, can make it difficult to thoroughly instrument, cleanse, and shape the canals. (Figure 1) Such problems of accessibility can result in the persistence of microbes and residual infection, the inability of irrigants to reach the area, and difficulties in sampling to determine whether a microbial load is still present.11

Table 1. Potential complications during and following treatment

<table>
<thead>
<tr>
<th>Continued presence of infection</th>
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<tbody>
<tr>
<td>Canal blockage</td>
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<tr>
<td>Overinstrumentation</td>
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<td>Root canal perforation</td>
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<tr>
<td>Creation of ledges and pseudo canals</td>
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<tr>
<td>Lack of coronal seal</td>
</tr>
<tr>
<td>Recurring infection</td>
</tr>
<tr>
<td>Coronal fracture</td>
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</table>

In order to navigate through calcified structures, the clinician will first attempt to negotiate the canal system with very sharp pointed-tip files, typically No. 8 or No. 10 files. It has been suggested12 that these files should be precurved to increase the tactile sensitivity of the operator and should be used with minimal apically directed pressure during attempts to slip and slide between these “stones” and gain access to the original path of the canal. Once this is done, the debris can be removed with a backward carving motion and larger instrumentation (such as files and reamers of various designs including Hedstrom files with backward-facing cutting edges for rapid canal enlargement) can be introduced to continue the cleansing and shaping of the canal system. Once this is done, the debris can be removed with a back-ward carving motion and larger instrumentation can be introduced to continue the cleansing and shaping of the canal system. (Figure 2) Sharp-tipped Gates-Glidden drills have also been used to remove calcified tooth structure and gain access. (Figure 3) The process can be very time consuming and needs to be carried out with care and patience. For the removal of the pulp and pulpal remnants, barbed broaches are often used.

Figure 1. Calcifications

Figure 2. Hedstrom files

Figure 3. Sharp-tipped Gates-Glidden drills

During the ’60s, ’70s, and ’80s, hand instrumentation and a “watch winding” technique became a standard, whereby reamers were used, intermittently followed by files and irrigants. This “watch winding” technique involved rotating the files 20 to 30 degrees, sequentially and repeatedly, in clockwise and counterclockwise directions using only light apical pressure and allowing the files to advance. Each file size was used for no more than 10 seconds and the next file was then used. Many different concepts and systems have been developed over the years to make the procedure easier and more predictable for the clinician, and instrumentation of the canal systems has also undergone multiple changes. Curvatures of the canal systems, which are inevitably present in many cases, created havoc with many treatment techniques rendered over the years. (Figure 4) Precurving of stainless steel files was found to be a necessary technique addition as the science of endodontics evolved.13

Figure 4. Curvature of canals

Image courtesy of Dr. Manish Garala
The introduction of Ni-Ti hand files eliminated the need for precurving, since these files have the ability to navigate the canal system and aid in the cleansing and shaping of curved canals. However, metal fatigue was and is seen when Ni-Ti files are used or if any attempt to precurve these instruments is made, thus leading to the possibility of separation of the file within the canal, creating additional treatment complications.14,15 The development of rotary Ni-Ti instruments is often considered one of the most important advances in endodontic treatment. This has led to the creation of numerous rotary instrumentation systems that have certainly helped enhance the care rendered for our patients and have decreased the time needed to treat endodontic cases. With rotary Ni-Ti files we have improved the overall efficiency of endodontic treatment.16 Ni-Ti rotary systems have been developed for both the “step down” and the “step back” techniques. (Figure 5) To overcome rotary Ni-Ti drawbacks, several alternatives were developed.

The “step back” or serial technique uses fine instruments starting at the apex and working up the canal with progressively larger instruments,17 is used with hand instruments, and was designed to help reduce instrument transportation or “zipping” in the apical third of the canal system. “Zipping” damage destroys the apical constriction, transports the narrowest widths of the canal, and prevents proper cleansing and filling of the apical region of the canal system. The “step down” or “crown down” technique18 requires starting with larger instruments at the orifice of the canal and gradually moving toward the apex with smaller and smaller instruments. There have also been modifications and blendings of both techniques in attempts to simplify the procedures. An apex locator is helpful and can be attached to rotary Ni-Ti reamers while instrumentation of the canals is carried out.

Each instrumentation system uses a set sequence of Ni-Ti rotary files requiring a number of steps and instruments. Along with the improvements in speed and efficiency, variations in the shapes created by these instruments at the apex occur, and there is the potential for canal transportation and excessive dentin removal. One of these involved the use of instruments with variable tapers along the flutes to achieve better access, efficiency, and safety. Additional goals of this system were to avoid overpreparation of the coronal portion of the canal and to be able to shape the majority of canals with a minimum number of rotary files (typically up to 4). Ground as well as twisted Ni-Ti files are now available. Recent studies suggest that engine-driven instruments, which are usually used with a crown-down technique, are more effective than hand instruments and result in fewer instrument fractures.19

**Table 2. Instrumentation methods**

| Hand instruments: files, reamers, broaches, and Hedstrom files |
| Engine-driven instruments with and without a reciprocating handpiece |
| Gates Glidden drills |
| Peezo reamers |
| Sonic and ultrasonic instrumentation |

Another advancement has been an instrumentation system that combines the use of stainless steel-relieved reamers along with a Peezo-like instrument and Ni-Ti reamers. These reamers consist of a series of noncircular, noninterrupted flat-sided reamers that are designed to reduce endodontic stress and instrument separation.20 (Table 2) The relieved areas are claimed to result in less engagement and catching on the dentinal walls of the root canals (Figure 6), thus bringing less risk of file separation, while the vertical blades and flat sides are designed to increase debris removal during instrumentation and the cutting tip allows the reamer to pierce the tooth tissue without creating resistance. While similar to stainless steel or Ni-Ti files and reamers in that they have the typical “handle” on each instrument, these instruments have one side that is flat with 16 flutes, as opposed to standard files, which are rounded and have 24 flutes. These reamers are used with a reciprocating handpiece to shape and prepare the root canal system. As with all rotary endodontic instruments, the hand motion is up and down in a piston-like fashion, although with less force, and the handpiece reciprocation rotates the reamers in a 30-degree clockwise/counterclockwise motion. As with several other systems, if desired, the reamers can first be used for hand instrumentation using the watch-winding technique.
Irrespective of the system used, the canals are flared after attainment of working length. In the case of a curved canal, care must be taken to ensure that flaring does not result in acentric shaping of the canal or, in extreme cases, perforation of the canal or reduction of dentin thickness adjacent to furcations, as this could result in subsequent perforation of the tooth. (Figure 7)

Recent studies suggest that engine-driven instruments, which are usually used with a crown-down technique, are more effective than hand instruments and result in fewer instrument fractures.

Irrigation
Proper irrigation of the root canals during shaping and cleansing is essential to remove debris and microbes as well as the smear layer present on the dentinal walls. The irrigant should have broad antimicrobial properties and have the ability to safely and effectively disinfect the canals, dissolve organic tissue (necrotic and pulpal) and inorganic tissue, and remove debris. Available root canal irrigants include sodium hypochlorite, hydrogen peroxide, chlorhexidine gluconate, ethylenediaminetetraacetic acid (EDTA), and alcohol. However, Enterococcus faecalis and Actinomyces israelii—which are both implicated in endodontic infections as well as in endodontic failure—penetrate deep into the dentinal tubules, making their removal through mechanical instrumentation impossible and making irrigant selection and use critical.\(^{21,22}\) The ability of the irrigant to remove the smear layer (alone or in combination with another irrigant), dissolve organic and inorganic materials, and remove debris, as well as its biocompatibility, must be considered. Regarding the calcifications referred to earlier in this article, in addition to root canal instrumentation to remove these, EDTA is helpful.\(^{23,24}\) Further, the irrigation technique must include intermittent irrigant use between instrumentation steps and must prevent extrusion of the irrigant through the apex or lateral canals and not let it reach the intra-oral environment (the latter accomplished by use of a rubber dam). The full length of the canal walls must be reached.

The ability of an irrigant to remove the smear layer, dissolve organic and inorganic materials, and remove debris, as well as its biocompatibility, must be considered.

Root Canal Fillers and Canal Obturation
Filling materials such as silver points were used for a period of time, until it was discovered that the excessive use of this material could lead to argyria, a condition caused by the improper exposure to chemical forms of the element silver, which in the most extreme of situations can turn the skin blue or bluish-gray in color. The use of such materials in combination with sealers also resulted in root canal fillings that were inadequate for obturation and corroded.\(^{25}\) Gutta-percha, derived from tropical trees in the South Pacific, is both bioinert and resilient and is combined with zinc oxide, plasticizers, and radiopacifiers to create gutta-percha points. Its biocompatibility and malleability have given it an important role in endodontics, and it has become the standard material used in the obturation of endodontically treated teeth. This material is available in various taper configurations.

Gutta-percha has been used in a cold lateral condensation technique and a warm vertical condensation technique. The lateral condensation technique requires the use of a “master cone” of gutta-percha, which needs to fit so that it exhibits a “tug back” within the apical third of the canal. Once this is achieved, the “master cone” is coated with an endodontic “sealer” material and placed in the canal, after which a radiograph must be taken to ensure that the master cone is correctly positioned apically. Using endodontic spreaders, multiple accessory gutta-percha cones are then laterally condensed around the master cone in order to create a deformation in the material against the other cones. This allows complete filling of the canal system while trying to create a “cold weld” of the material.

One of the most commonly used sealer materials for this and many other endodontic obturation procedures was a derivation of “Grossman’s Sealer.” The “1974”\(^{26}\) derivation consisted of powder containing hydrogenated
resin, zinc oxide, and anhydrous sodium tetraborate, and a liquid containing eugenol and 4% zinc chloride solution. Many commercial derivations of this sealer are still available today. Sealers can be applied to the root canal system using Lentulo spinners which are first coated with the sealer and then placed into the canals without engaging the walls. (Figure 8) The Lentulo spinners are unidirectional, and should be rotated slowly to gently release the sealer. Another option is a bidirectional instrument that, as the name suggests, moves backwards and forwards. (Figure 9) This bi-directional spiral is first coated with the sealer - typically epoxy resin - and then placed in the canal. The bi-directional spiral is used with a slow-speed handpiece, and the handpiece moves in a piston-like fashion in an up-and-down motion to gently release the sealer into the canal and coat it laterally away from the apex, thereby helping to avoid over-fills.

Schilder et al. developed a warm gutta-percha technique that incorporated a vertical pressure applied to compensate for volume changes that occur as cooling takes place in the gutta-percha. This led to the use of the warm vertical condensation technique, whereby the master cone is selected that will tightly fit the canal to within 0.5 mm to 2 mm of working length. After application of the sealer, the cone is placed and condensed with a warm pluggers once the coronal portion of the point has first been removed with a warm instrument. By repeating the process with small incremental lengths of gutta-percha points, and each time more coronally, the clinician can fill the length of the root canal with condensed gutta-percha.

The curvature and the length of the canal must be considered with respect to the obturation materials and technique. Condensation forces can be either lateral forces, which will push the filling material against the walls of the canal system and into lateral canals, or vertical forces, which will push the filling materials in an apical direction and can increase the risk of extrusion of the material. Optimized condensation forces require a delicate balance between the taper and diameter of the canal, the master cone, and the pluggers used for condensation. Use of pluggers that have similar taper and diameter to that of the master cone will allow pressure to be directly applied to the gutta-percha and help prevent pressure against the canal wall, which could result in damage to the root system.

Many variations were developed on the above concepts, including thermo-plasticized gutta-percha filling techniques. These include the use of a syringe containing thermo-plasticized gutta-percha that is extruded into the canal and back-filled, as well as metal and later plastic carriers coated with thermo-plasticized gutta-percha that are placed into the canal once the correct size of carrier has been determined. (Figure 10) The development of plastic-core carriers has made it easier to remove the excess length of the gutta-percha carrier coronally through the use of a heated instrument. Another carrier-based system uses a plug of gutta-percha at the apical end of the carrier; the plug is placed in the canal, and the metal portion sectioned at the length required coronally to enable sealing of the canal. Other systems utilize gutta-percha that has been heated using a device that regulates the temperature of the thermo-plasticized gutta-percha. (Figure 11) One device consists of a handheld, battery-operated heated pluggers, again regulating the temperature—in this case of the pluggers. Another system combines the use of heated gutta-percha with use of a spreader tip that can be used with or without vibration during root canal obturation. This particular device can be used for either traditional obturation technique. (Table 3)
With all thermo-plastic techniques, the flow of gutta-percha in the heated form into the canal depends on the condensation forces, root canal anatomy (curvature), the viscosity of the material and the sealer, and the efficiency and expertise of the clinician. Consideration must also be given to the contraction of gutta-percha that can occur as it cools.

Table 3. Root canal obturating materials

<table>
<thead>
<tr>
<th>Gutta-percha and sealer</th>
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<tbody>
<tr>
<td>Resin-based filler and sealer</td>
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<tr>
<td>Gutta-percha plastic carriers/cores</td>
</tr>
<tr>
<td>Resin-based plastic carriers/cores</td>
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</tbody>
</table>

Resin-based fillers and sealant are also available for root canal obturation. Resin-based systems utilize either a methacrylate resin-based sealant with gutta-percha or a methacrylate resin-based sealant together with a resin-based core. The objective of this is to bond the core and the sealant to each other and to the tooth (which cannot be done with the use of gutta-percha). Epoxy resin-based sealant is used with a single gutta-percha master cone, with the epoxy resin sealant taking up the space around the master cone and setting to provide a fill with little or no shrinkage of the sealant.28 Glass ionomer technology has also been used, involving a coating incorporated onto gutta-percha points and use of a complementary glass ionomer sealant. As with the epoxy resin technique described above, a single master cone is used. The cases below demonstrate the use of 2 different techniques for endodontic therapy.

**Case 1.**
In this case, the patient complained of pain in tooth #14. Following examination it was determined that the patient had irreversible pulpitis, necessitating endodontic therapy. Treatment involved the use of twisted Ni-Ti files using the “crown-down” technique. (Figures 12a,b)

**Case 2.**
In this case, the patient presented with a large distal carious lesion in tooth #13. Flat-sided reamers were used during endodontic therapy, followed by obturation obtained using epoxy resin with a bidirectional spiral instrument followed by a single gutta-percha cone. (Figures 13a-d)
Conclusion
Many instrumentation and obturation techniques are available for endodontic therapy. Careful technique and selection of instruments are essential for successful outcomes, and clinicians should consider the safety of specific types of instruments and the effectiveness with which the instruments prepare the canals for obturation.

References

Author Profile
Dr. Comisi has been in private practice in Ithaca, NY since 1983. He is a graduate of Northwestern University Dental School and received his Bachelor of Science in Biology at Fordham University. He is a member of the American Dental Association and its tripartite organizations, the Academy of General Dentistry, the American Equilibration Society, the International and American Association of Dental Research, a Research Associate at New York University Dental School. Dr. Comisi is a Master of the Academy of General Dentistry, and holds Fellowships in the Academy of Dentistry International, the American College of Dentistry, the Pierre Fauchard Academy and the International College of Dentistry.

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Questions

1. Incomplete or partial pulpotomies are considered the standard of care.
   a. are
   b. were
   c. have never been
d. are sometimes

2. Current and recent endodontic treatment modalities have resulted in success rates of up to 98% where _____ was present at the time of treatment.
   a. apical periodontitis
   b. lateral periodontitis
c. genetically-related periodontitis
d. none of the above

3. _____ is a primary factor in the success or failure of pulpectomies.
   a. The ability to thoroughly prepare the root canal system
   b. The ability to thoroughly fill the root canal system
c. The absence of apical periodontitis
   d. all of the above

4. The overall goal of endodontic therapy is _________.
   a. long-term retention of the tooth
   b. long-term restoration of the tooth
c. complete healing of the periapical tissues
d. all of the above

5. The root canal system is obturated to create a hermetic seal _________.
   a. apically
   b. coronally
c. laterally for accessory canals
d. all of the above

6. Thin dentinal walls of the roots are predisposed to _________.
   a. canes
   b. sensivity
c. fracture
d. all of the above

7. Success in achieving the objectives of endodontic therapy is dependent on the use of a thorough, step-by-step technique utilizing _________.
   a. suitable instrumentation
   b. irrigation
c. obturation materials
d. all of the above

8. ________ can be used to cleanse and shape the canals.
   a. Endodontic files and reamers
   b. Lentulo spinners
c. Gates-Glidden drills
d. none of the above

9. ________ could ultimately lead to failure of the endodontically treated tooth.
   a. Blockage of the canal system
   b. The creation of “pseudo” canals
c. Perforation of the canal
d. all of the above

10. Calcified structures can occur naturally as a ________ response to various challenges experienced by the tooth.
    a. chemical
    b. cellular
c. physiological
d. all of the above

11. ________ can make it difficult to thoroughly instrument, cleanse, and shape the canals.
    a. Accessory canals
    b. Anatomoses
c. Calcifications
d. all of the above

12. ________ is a potential complication during and following endodontic treatment.
    a. Intracanal caries
    b. Recurring infection
c. Recurring apicitis
d. all of the above

13. In order to navigate through calcified structures, the clinician will first attempt to negotiate the canal system with _________.
    a. Flexed oval cross-section files
    b. Curved lentulo spinners
c. Very sharp pointed-tip files
d. all of the above

14. The “watch winding” technique involves rotating the files _________.
    a. 5 to 10
    b. 10 to 15
c. 20 to 30
d. 30 to 40

15. The introduction of Ni-Ti hand files eliminated the need for _________.
    a. Prestressing
    b. Precurving
c. Separation
d. none of the above

16. Ni-Ti files _________.
    a. have the ability to navigate the canal system
    b. should always be pretreated
c. aid in the cleansing and shaping of these curved canals
d. a and c

17. Ni-Ti rotary systems have been developed for the ________ and ________ techniques.
    a. “crown down” and “crown back”
    b. “step down” and “step back”
c. “step down” and “rotate back”
d. all of the above

18. The “step back” technique uses _________.
    a. Large instruments starting at the crown of the root canal
    b. Large instruments starting at the apex of the root canal
c. Fine instruments starting at the crown of the root canal
d. Fine instruments starting at the apex

19. Recent studies suggest that engineered instruments are ________ hand instruments.
    a. less effective than
    b. as effective as
c. more effective than
d. all of the above

20. The relieved areas on flat-sided reamers are intended to _________.
    a. Result in less engagement
    b. Result in less catching
c. Bring less risk of file separation
d. all of the above

21. A barbed broach can be used to _________.
    a. Remove pulp remnants
    b. Irrigate the canal
c. Enlarge the canal
d. all of the above

22. Proper irrigation of the root canals during shaping and cleansing is essential to remove _________.
    a. Debris
    b. Microbes
c. The smear layer on the dentinal walls
d. all of the above

23. ________ is helpful to remove calcifications.
    a. Root canal instrumentation
    b. Ethanol
c. EDTA
d. a and c

24. The ________ technique requires the use of a “master cone” of gutta-percha, which needs to fit such that it exhibits a “tug back” within the apical third of the canal.
    a. Vertical condensation
    b. Apical condensation
c. Lateral condensation
d. all of the above

25. The ________ must be considered with respect to the obturation materials and technique.
    a. Curvature of the canal
    b. Length of the canal
c. Number of canals
d. a and b

26. ________ is an option for obturation of root canals.
    a. Thermo-plasticized gutta-percha in a syringe
    b. The use of plastic carriers
    c. The use of a spreader tip with vibration
d. all of the above

27. The flow of heated gutta-percha into the canal depends on the condensation forces and _________.
    a. Root canal anatomy
    b. The viscosity of the material and the sealer
c. The efficiency and expertise of the clinician
d. all of the above

28. ________ can be used for transporting sealer into the root canals.
    a. Lentulo spinners
    b. Hedstrom files
c. Bi-directional spiral instruments
d. a and c

29. Resin-based systems utilize _________.
    a. A methacrylate resin-based sealant
    b. A methacrylate resin-based sealant together with a resin-based core
c. A methacrylate resin-based sealant together with a silver point
d. a or b

30. ________ is essential for successful endodontic treatment outcomes.
    a. Careful technique
    b. Careful selection of instruments
c. Consideration of the efficacy and safety of instruments
d. all of the above
### Educational Objectives

1. List and describe the overall goal and objectives of endodontic treatment.
2. Define and describe endodontic instrumentation options.
3. Discuss the requirements for a root canal irrigant.
4. List and describe currently available root canal obturation techniques.

### Course Evaluation

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<td>Objective #3:</td>
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<td>Objective #4:</td>
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Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?  
   Objective #1: Yes No
   Objective #2: Yes No
   Objective #3: Yes No
   Objective #4: Yes No

2. To what extent were the course objectives accomplished overall?  
   5 4 3 2 1 0

3. Please rate your personal mastery of the course objectives.  
   5 4 3 2 1 0

4. How would you rate the usefulness and clinical applicability of this course?  
   5 4 3 2 1 0

5. How do you rate the author’s grasp of the topic?  
   5 4 3 2 1 0

6. Please rate the instructor’s effectiveness.  
   5 4 3 2 1 0

7. Was the overall administration of the course effective?  
   5 4 3 2 1 0

8. Please rate the usefulness and clinical applicability of this course.  
   5 4 3 2 1 0

9. Please rate the usefulness of the supplemental webliography.  
   5 4 3 2 1 0

10. Do you feel that the references were adequate?  
    Yes No

11. Would you participate in a similar program on a different topic?  
    Yes No

12. If any of the continuing education questions were unclear or ambiguous, please list them.

13. Was there any subject matter you found confusing? Please describe.

14. How long did it take you to complete this course?  

15. What additional continuing dental education topics would you like to see?

### Answer Sheet

**PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.**

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**ANSWER SHEET**

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<tr>
<td>Objective #3:</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Objective #4:</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?  
   Objective #1: Yes No
   Objective #2: Yes No
   Objective #3: Yes No
   Objective #4: Yes No

2. To what extent were the course objectives accomplished overall?  
   5 4 3 2 1 0

3. Please rate your personal mastery of the course objectives.  
   5 4 3 2 1 0

4. How would you rate the usefulness and clinical applicability of this course?  
   5 4 3 2 1 0

5. How do you rate the author’s grasp of the topic?  
   5 4 3 2 1 0

6. Please rate the instructor’s effectiveness.  
   5 4 3 2 1 0

7. Was the overall administration of the course effective?  
   5 4 3 2 1 0

8. Please rate the usefulness and clinical applicability of this course.  
   5 4 3 2 1 0

9. Please rate the usefulness of the supplemental webliography.  
   5 4 3 2 1 0

10. Do you feel that the references were adequate?  
    Yes No

11. Would you participate in a similar program on a different topic?  
    Yes No

12. If any of the continuing education questions were unclear or ambiguous, please list them.

13. Was there any subject matter you found confusing? Please describe.

14. How long did it take you to complete this course?  

15. What additional continuing dental education topics would you like to see?  

**PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.**

**EDSENDO911**

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