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## Restoring Full Crowns with Composite Cores

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### COURSE OBJECTIVES

At the completion of this program the participant will be able to:

- List the indications for composite core-foundations.
- List choices for direct placement restorative materials that can be used for composite core-foundations.
- List methods to retain the restorative materials used for large core-foundations.
- Describe the clinical sequence for treatment of tooth receiving a composite core-foundation from preparation to completed full coverage crown.

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### COURSE ASSESSMENT

Your feedback is important to us. Please complete the brief Course Evaluation survey at the end of your booklet. Your response will help us to better understand your needs so we can tailor future courses accordingly.

### WHY TAKE THIS COURSE?

To gain a thorough understanding of the use of composite resin as a core/foundation material.

**PATIENT CARE**—With the latest generation of composite core materials, restoring badly broken-down teeth with an adhesive composite resin is an acceptable alternative to traditional amalgam cores.

**CONVENIENCE**—Continue your education without traveling, taking time away from work and family or paying high tuition, registration and material costs.

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### WHO SHOULD TAKE THIS COURSE?

Dentists, Dental Assistants, and Dental Hygienists.

**Introduction**

For teeth that require larger than routine-sized direct tooth restorations with amalgam or composite resin where cusps are replaced with restorative material, there is a high potential for that tooth to need a crown when an onlay is not indicated. These may be teeth that are restored early in a patient's life. Through their normal restorative cycle of restoration replacement due to recurrent caries, tooth or restoration fracture, or normal restoration breakdown, they have become larger than what one can expect a cusp replacement restoration to have durability with. It may be the circumstance of a patient who is not seeking regular dental care with a high caries risk, who is now seeking care and there

is significant damage to the tooth due to tooth fracture, caries wear multiple surface restorations where the weakened tooth structure will require definitive restoration with a full coverage crown.<sup>(1)</sup> In these circumstances, before preparation and restoration with a crown, the tooth will need replacement of an existing restoration or preparation to remove caries or defective restorative material before a crown preparation can be done. In some cases, the tooth has undergone endodontic treatment. Not only is the tooth missing coronal tooth structure, but the tooth has been hollowed out by the endodontic treatment. In all of these cases, a core/foundation must be done before preparing and restoring the tooth with a crown.

There are choices for the restorative material used for a core/foundation restoration. A clinician can choose from amalgam, composite resin, and glass ionomer. Both amalgam and composite resin are excellent choices as restorative materials for cores.<sup>(1)</sup> Among the considerations for teeth with large preparations is how can the core restoration be retained? For amalgam and composite resin, retention of the restorative material can be accomplished using pins, slots and grooves in the preparation, adhesive<sup>(2, 3)</sup> and in the case of an endodontically treated tooth, a post. One benefit of using composite core materials, is the adhesive procedure is integral to the restoration. When amalgam and composite resin were compared as core materials under cast crowns, there were no significant differences in the degree of microleakage found with the crowns with both types of cores.<sup>(4)</sup> When compared with amalgam and composite resin, glass ionomer has comparatively weaker physical properties.<sup>(5, 6)</sup> Glass ionomer is the most limiting of the direct placement restorative materials used for cores because its physical properties demand that at least 50-60% of the tooth structure be remaining to support the final crown.<sup>(7)</sup> Glass ionomer should be limited to restoring teeth when sufficient tooth structure remains to support and retain the crown.<sup>(8,9)</sup> For this article the focus

**Table 1**  
Partial Listing of composite resin core restorative materials

MATERIAL	MANUFACTURER
CoreTEC Core Material Build-Up	Benco Dental
CoreTEC Fiber Reinforced Core Build-Up	Benco Dental
Fluorocore 2	Dentsply Caulk
TiCore	Essential Dental Systems
Bis-Core	Bisco
Core-Flo	Bisco
Core-Flo DC	Bisco
Light-Core	Bisco
CoreRetsore 2	Kerr
Spee-Dee Build-up	Pulpdent
HardCore	Pulpdent
Build-IT FR	Pentron
Encore	Centrix
Encore SuperCure	Centrix
Core Paste	Den-Mat
Core Paste XP Syringeable	Den-Mat
CompCore	Premier
CompCore AF Dual-Cure SyringeMix	Premier
Clearfil Core Build-up	Kuraray America
Clearfil Photo Core	Kuraray America
Gradia Core	GC America
Absolute Dentin	Parkell
Rebilda DC	Voco
LuxaCore Dual	Zenith
Blue Core Build-up	Waterpik
ParaPost ParaCore Automix	Coltene/Whaledent

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will be the use of composite resin as a core/foundation material.

When used as a crown foundation, composite resin demonstrates advantages over both amalgam and glass ionomer. Composite resins are bondable to tooth structure, which minimizes the need for additional retention and additional cavity preparation before placing the core restoration. Also, composite resin, either as a light-cure, self-cure or dual-cure formulation, is easy to place and adapt by syringing it into the cavity preparation, as compared to amalgam condensation, and it sets rapidly, so that the crown can be prepared in the same visit.<sup>(1)</sup> Some formulations of composite resins release fluoride and may provide an anticariogenic effect.<sup>(10)</sup> While shaded composite resins are used routinely to restore teeth, the choice of a composite resin that is slightly different in color, (colored to be significantly different in color from the normal tooth shade) is recommended when doing crown preparations, so that the tooth-composite resin junction is visible during tooth preparation.<sup>(1)</sup> For these cases, the tooth preparation should extend at least 1 mm past the core build-up.<sup>(11)</sup>

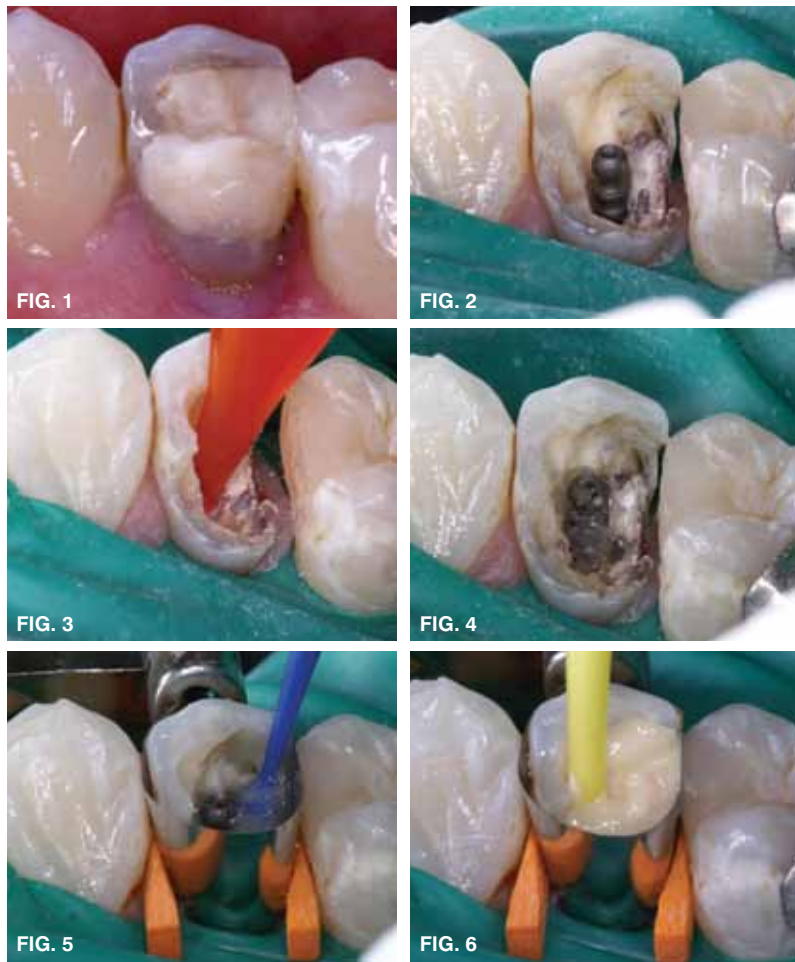
There are special considerations when restoring an endodontically treated tooth. In the case of an endodontically treated tooth, a number of studies have focused on functional stresses to the tooth crown when it is restored with a post and bonded composite resin versus restoring with an integral cast metal post and core. The results of these studies have demonstrated that failure occurs at the interface between the restorative material and the tooth.<sup>(12, 13)</sup> With this in mind, it is important when preparing a tooth restored with a core that will receive a crown, that the design of the crown preparation have a ferrule of at least 1-2 mm beyond the core material and the ferrule extend 360 degrees around the crown margins.<sup>(12, 14, 15)</sup> Ferrule refers to the tooth preparation for the crown margin to be prepared beyond the core material. For porcelain-metal restorations, the development of the ferrule in the crown preparation is less of a challenge than when preparing for a shoulder preparation for an all-ceramic crown. In all cases, tooth structure should be seen beyond the core material with your preparation.

### Choices for composite resin core materials

There are several choices for composite resin core/

foundation restorations. A clinician can select from light cured composite resins, self-cured composite resin, and dual-cured composite resin. All three types of composite resin have the physical properties compatible with a successful core/foundation restoration.<sup>(16-18)</sup> (Considerations for selection of composite resin for use, is access for light curing and bonding agent—adhesive—to be used.) When placing large core/foundation restorations with composite resin, access to light cure may be very limited. In the case of an endodontically treated tooth, the distance the light energy must travel to polymerize a composite resin within a pulp chamber contraindicates the use of a light cure composite resin.<sup>(19, 20)</sup> Self-cure and dual-cure composite resins used to restore large preparations assures the clinician of a complete setting and hardening reaction of the composite resin. (Table 1) One advancement in the use of dual-cure composite resin restoratives for core/foundation restorations, is the use of an automixing tip for easy and quick placement in the tooth preparation. The viscosity of these composite resins allows for ease of placement with excellent adaptation to the cavity walls and cavosurface margins. Concern for polymerization shrinkage and microleakage of composite resin used for cores is minimized because the restoration will be covered by a full coverage crown.

An area of recent investigation has been the compatibility of etch and rinse (fourth and fifth generation) adhesives and self-etch (sixth and seventh generation) adhesives with self-cure and dual-cure composite resins. There is contradictory evidence that some single bottle adhesive systems do not bond well to self-cure and dual-cure composite resins due to the acidity of the single bottle primer-adhesive. Studies demonstrating a decreased bond and other studies showing no effect have been reported.<sup>(21-24)</sup> Some recent studies evaluating self-etch bonding systems and compatibility with dual-cure and self-cure composite resins have demonstrated some changes in chemistry that has resulted in composite resin-adhesive compatibility.<sup>(25, 26)</sup> Some manufacturers have included a self-cure or dual-cure component to be mixed with their bonding agent to allow it to be used with self-cure and dual-cure composite resin core/foundation materials or self-cure or dual-cure composite resin cements.<sup>(27)</sup> This variability requires that the clinician review the manufacturer's recommendations for uses with etch and rinse adhesives



**Figure 1:** Endodontically treated maxillary second premolar with defective restoration. **Figure 2:** After sizing the post space, the IntegraPost was fitted to the root canal prepared post space. **Figure 3:** Dual cured resin cement injected into the root canal before post cementation. **Figure 4:** Post cemented. **Figure 5:** Application of dual cure adhesive (IntegraBond) to cavity preparation. **Figure 6:** Placing the composite core material (CompCore AF) with the automixing tip with an application tip on its end.

and self-etch adhesives with self-cure and dual-cure composite resins.

**Case report 1:  
Restoring an Endodontically Treated Maxillary Premolar**

A 24-year-old patient presented with an endodontically treated maxillary second premolar that had a defective, pin-retained composite resin restoration that restored the lingual cusp. (Figure 1) After a thorough periodontal, endodontic and hard tissue evaluation, the tooth was treatment-planned for a prefabricated post, and, if at all possible during removal of the defective restoration, retention of the existing pin, and restora-

tion with a composite resin core. The definitive restoration for the premolar was treatment-planned as an all-ceramic crown.

During the endodontic treatment, a post space was made that left at least 5 mm of remaining gutta percha to maintain the apical seal of the endodontic filling. The length of a post space should be at least ½ the root length while still maintaining the apical seal of gutta percha.<sup>(28, 29)</sup> The defective composite resin was removed using a 245-GW (Great White bur, SS White, Lakewood, NJ). The Great White bur was selected due to its fluted blades, being more dentated than crosscut burs with a unique geometry in the design of their blades, which creates a bur that cuts quickly and more efficiently with less vibration when cutting into tooth structure or dental materials. This translates into less stress on the tooth, its supporting periodontal structures, and pulp. During the endodontic treatment the endodontist had placed a cotton pellet and conventional glass ionomer (Fuji IX, GC America) to fill the access opening. During preparation, the pin previously placed was maintained and the endodontic access to the root canal was easily visualized when the glass ionomer and cotton pellet were removed. The prefabricated post selected to provide additional retention to the composite core was a parallel, sided serrated post with a retentive head design (IntegraPost, Premier Dental).<sup>(30, 31)</sup> The post space was sized

with the endodontic post reamer in the post kit and the post was selected and tried in. (Figure 2)

**Post cementation:**

A self-etching adhesive technique was used to cement the post. Using a microapplicator brush, a self-etching bond enhancer, Bond Boost SE (Premier Dental, Plymouth Meeting, PA), was thinly painted on all the walls of the root canal. Bond Boost SE can be used with any etch and rinse adhesive system as a substitute for acid etching of dentin. After 20 seconds the bond enhancer was gently air dried. A single bottle, 5th generation adhesive was mixed with its dual-cure activator (IntegraBond, Premier Dental) and thinly applied to the root canal. A dual cure composite resin cement (IntegraCem, Premier Dental)

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was injected into the root canal using an application tube (Centrix Dental) (Figure 3) and the post was cemented. (Figure 4)

### Core build-up:

For the case a composite core build-up material with unique properties was selected. CompCore AF SyringeMix Stack (Premier Dental) is a dual-cure composite core build-up material with hyper-branched polymer technology, fluoride release and a high radiopacity. It is available in two colors that are easy to distinguish from tooth structure during a crown preparation; shade A3 as a dentin shade that can be used underneath all-ceramic restorations, or white for any core build-up for metal and porcelain metal crowns. The stackable consistency of the composite allows it to be placed without fear of flow away from the cavity margins, yet its viscosity permits easy adaptation to the preparation cavity walls, margins and matrix band.

After post cementation, a matrix band and wedges were applied to the tooth preparation. Bond Boost SE was reapplied to cavity preparation for 20 seconds and air dried. IntegraBond was mixed with its activator to make it dual cure and was applied to the cavity preparation with a disposable micro-brush applicator. (Figure 5) The dual-cured, fluoride releasing composite core material (CompCore AF SyringeMix Stack) was applied directly from its dual-barreled syringe using an automixing tip with application tip. (Figure 6) For snap polymerization, the core was light cured for 30 seconds with a quartz halogen curing light (Optilux 501, Kerr Demetron) keeping the light probe as close to the preparation as possible with the light probe at right angles to the tooth preparation. (Figure 7, 8) The composite core was restored in one application. (Figure 8) The matrix was removed and composite resin core was finished, occlusion adjusted and evaluated since it would be used to make the template for the provisional crown restoration. (Figure 9) For fabrication of the provisional restoration, a bite impression template was made with a fast setting regular body vinyl polysiloxane impression material.



FIG. 7



FIG. 8

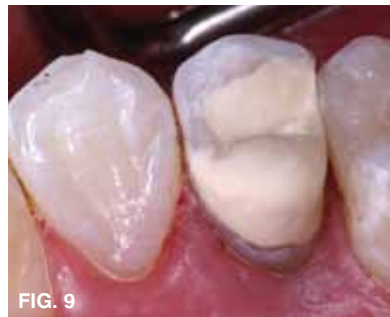


FIG. 9



FIG. 10



FIG. 11A



FIG. 11B



FIG. 12

**Figure 7:** Composite was light cured for 30 seconds. **Figure 8:** Composite after light curing. **Figure 9:** Composite core finished so it can be a template tooth for the provisional crown restoration. **Figure 10:** Crown preparation for all-ceramic crown with shoulder margins using a shoulder diamond (Piranha) **Figure 11A:** Facial view of final crown preparation demonstrating a ferrule effect. **Figure 11B:** Lingual view of crown preparation. **Figure 12:** Facial view of all-ceramic crown (Procera) after cementation.

### Crown restoration

The maxillary premolar was prepared for an all-ceramic zirconia core crown using a shoulder preparation diamond (Piranha, SS White Burs). (Figure 10) The final crown preparation demonstrated sufficient ferrule with the composite core and that the CompCore AF shade A3 provided a differentiation in color from the tooth to be certain the margins were on sound tooth structure. (Figure 11A-B) An impression was made using a bite im-

pression technique with a fast setting regular body VPS impression material (ExaFlex, GC America). A provisional restoration was fabricated using the bite-impression template technique with a bis-acryl provisional resin material (Integrity, Dentsply Caulk). The provisional restoration was adjusted and polished and then cemented on the premolar with an auto-mixing, neutral shaded, eugenol-free temporary resin cement that contained fluoride, potassium nitrate for desensitizing, and antimicrobial chlorhexidine (NexTemp, Premier Dental).

The impression was sent to the dental laboratory for fabrication of the all-ceramic crown with a zirconia coping (Procera, Nobel Biocare). The crown was returned by the laboratory and was tried in and adjusted for proximal contact and occlusion. The margins were evaluated and determined to be very well fitting. The Procera crown was cemented using the same adhesive technique as was described for the post system—self-etching bond enhancer (Bond Boost SE) applied for 20 seconds and dried, dual-cure fifth generation adhesive (IntegraBond) and a dual-cure composite resin cement (IntegraCem). The cement was applied very thinly into the crown and the crown was cemented having the patient gently bite down on a saliva ejector to provide mechanical force to fully seat the restoration. The cement was cleaned away and the occlusion was checked again. The final restoration was highly esthetic. (Figure 12)

## Conclusion

With the latest generation of composite core materials, restoring badly broken down teeth with an adhesive composite resin is an acceptable alternative to traditional amalgam cores. Major benefits of using a composite core material are rapid set for immediate preparation for a crown, no need for additional retention due to adhesive technique and acceptable physical properties to support a crown.

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## TEST QUESTIONS

1. **The indications for composite core/foundations include all the following EXCEPT. The EXCEPTION is**
- larger than routine sized preparations where cusps need to be replaced with restorative material.
  - restoration of pit and fissure caries.
  - a tooth with an existing MOD amalgam restoration with a cusp fracture of the entire lingual surface.
  - a tooth that has had endodontic treatment that is missing more than 2/3rds of the crown.
2. **According to this article all the following are choices for restorative materials to be used for direct placement core/foundations EXCEPT. The EXCEPTION is**
- amalgam
  - composite resin
  - zinc oxide and eugenol
  - glass ionomer
3. **Retention of restorative materials for large preparations that are to be core/foundations can be accomplished with**
- pins
  - slots and grooves in the preparation
  - endodontic posts
  - adhesives
  - all the above can be used to retain core/foundation restorations.
4. **Composite resins have an advantage over amalgam when restoring large preparations for core/foundations in that**
- The restorative material completely sets during the placement visit can be easily prepared for the crown the same visit.
  - when using the same shade as the tooth it is easily visible between core and tooth margin when preparing a crown.
  - The composite has much better physical properties than amalgam when the crown is in place.
  - the composite is softer and is easier to prepare for a crown preparation.
5. **According to this article when compared to amalgam and composite resin the use of glass ionomer restoratives as a core/foundation**
- has better physical properties and should be used because it has fluoride release.
  - is better when used in conjunction with an endodontic post.
  - is limited to those preparations that have at least 50-60% remaining tooth structure.
  - should be limited to ceramic inlay/onlays.
6. **Composite resin offers a number of advantages when used as a core/foundation restoration. Advantage(s) include**
- bondable to tooth structure
  - easy to adapt to the cavity preparation
  - sets rapidly so a crown preparation can be done the same visit.
  - all the above.
7. **When using composite resin, it is recommended that a shade/color be used that is slightly different than the color of the normal tooth structure. When preparing a crown preparation the margins of the crown should extend at least how far past the core/foundation margins?**
- 0.25 mm
  - 1.0-2.0 mm
  - 2.5-3.0 mm
  - 3.0-4.0 mm
8. **Composite cores can be used successfully to restore endodontically treated teeth. Extending the crown preparation margins beyond the core material is referred to as a**
- ferret
  - post-u-late
  - ferrule
  - corestore
9. **Ferrule, as it is defined relative to the crown preparation, refers to**
- incisal reduction.
  - facial/buccal reduction.
  - lingual reduction.
  - the crown margin being prepared beyond the core material.
10. **When preparing a crown preparation where a significant amount of the crown is restored with a composite core, it is**

- important that the preparation onto sound tooth structure be extended**
- 90 degrees around the crown margin.
  - 180 degrees around the crown margin.
  - 270 degrees around the crown margin.
  - 360 degrees around the crown margin.
- 11. The composite resin type that can be used for a core/foundation is (are)**
- self-cure composite
  - light-cure composite
  - dual-cure composite
  - all the above.
- 12. According to this article, when restoring an endodontically treated tooth where the composite resin will extend into the pulp chamber, it is recommended that**
- a light-cured composite be used.
  - a self-cured composite be used
  - a dual-cured composite be used.
  - b and c.
- 13. Innovation in the placement of dual-cure and self-cured composite resin as a core/foundation include:**
- dual-cartridge automixing tips for easy and quick placement.
  - viscosity compatible with ease of placement.
  - viscosity compatible with excellent adaptation to the cavity preparation walls.
  - all the above.
- 14. Concern for polymerization shrinkage and microleakage of a self-cure or dual-cure composite resin when used for a core/foundation is minimized because the restoration will be covered by a full crown.**
- True.
  - False.
- 15. At one time, it was contraindicated to use a self-etch adhesive or a fifth generation etch and rinse adhesive with dual-cure and self-cure composite resins. Some manufacturers have included a self-cure or dual-cure component to be mixed with their bonding agent to allow it to be used with self-cure and dual-cure composite resin core/foundation materials or self-cure or dual-cure composite resin cements.**
- Both statements are true.
  - The first statement is true the second statement is false.
  - Both statements are false.
  - The first statement is false the second statement is true.
- 16. According to this article, when preparing a post space at least how many millimeters of gutta percha should be maintained to provide for an apical seal of the root canal filling material?**
- 1 mm
  - 2 mm
  - 3 mm
  - 5 mm
- 17. When restoring an endodontically treated tooth with a post, the length of the post should extend at least**
- At least ½ the root length.
  - At least 1/3 the root length.
  - 3 mm past the CEJ.
  - 5 mm past the CEJ.
- 18. According to this article, removal of defective restorative materials (composite resin and/or amalgam) is best accomplished using**
- a fine grit 50 micron flame shaped diamond
  - a Great White bur with a unique dentated configuration of blades.
  - a polymer bur.
  - a heated instrument.
- 19. In this article, the crown substrate to be cemented to the composite resin core was**
- porcelain-noble metal
  - porcelain-base metal
  - all-ceramic crown with zirconia coping
  - composite resin
- 20. According to this article, amalgam is a superior core/foundation material to composite resin.**
- True.
  - False.



Course Order Number [4317-535]

NAME: \_\_\_\_\_

TITLE: (CIRCLE ONE)    DDS    DMD    RDH    CDH    RDA    CDA    EFDA

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**MAILING INSTRUCTIONS:** When you finish reading the course text, use the form to submit your answers to the self test. Fill in the correct box for each question indicating your answer. Pen or pencil may be used. There should be only one correct answer for each question. Upon completion of the course, mail the answer sheet to: Benco Dental, Attn: Education Department, 295 CenterPoint Boulevard, Pittston, PA 18640

**NOTE:** We recommend that you photocopy your answers before mailing this course. This will ensure that you have a record of your course completion in case of loss due to postal system error.

**COURSE EVALUATION:** Please take a moment to answer the questions below. Your responses will help us in developing future course material. Your feedback is important in evaluating the content and value of our courses. Please indicate how well the course met the criteria below. Circle one number in each criteria: 1=Poor, 2=Average, 3=Good, 4=Excellent.

The course provided clear information about the topic.	1	2	3	4
The course had relevance for my practice.	1	2	3	4
Overall rating	1	2	3	4
The course evaluated my understanding of the topic through the post-course questions.	1	2	3	4

How likely would you be to take a similar course on a different topic in the future?  
 highly unlikely       highly likely

On a scale of 1-5 (5=Excellent, 0=Poor), please rate the following:

Course Objectives	0	1	2	3	4	5
Course Content	0	1	2	3	4	5
Author's Grasp of Topic	0	1	2	3	4	5
References	0	1	2	3	4	5
Overall Effectiveness	0	1	2	3	4	5

Was the course clearly written and easy to understand?       Yes       No

If no, please describe: \_\_\_\_\_

Which additional continuing education topics would you be interested in?  
 \_\_\_\_\_

Additional Comments: \_\_\_\_\_  
 \_\_\_\_\_

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Please check if you would like to receive your score with your certificate of completion.

**ANSWER KEY**

1. (A) (B) (C) (D)
2. (A) (B) (C) (D)
3. (A) (B) (C) (D) (E)
4. (A) (B) (C) (D)
5. (A) (B) (C) (D)
6. (A) (B) (C) (D)
7. (A) (B) (C) (D)
8. (A) (B) (C) (D)
9. (A) (B) (C) (D)
10. (A) (B) (C) (D)
11. (A) (B) (C) (D)
12. (A) (B) (C) (D)
13. (A) (B) (C) (D)
14. (A) (B)
15. (A) (B) (C) (D)
16. (A) (B) (C) (D)
17. (A) (B) (C) (D)
18. (A) (B) (C) (D)
19. (A) (B) (C) (D)
20. (A) (B)

CUT ALONG DOTTED LINE