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Managing the immature apex in permanent teeth

A peer-reviewed course written by Rico D. Short, DMD, BCE, FICD

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Managing the immature apex in permanent teeth

Abstract

The management of immature permanent teeth with pulpal disease can be a daunting task. It is critical to properly diagnose and understand how to treat these cases. Modern technology in dentistry, such as cone beam technology, microscopes, and bioceramics, has made diagnosing and treating these teeth much more predictable. Without these advances in dentistry, it would be difficult to properly debride, clean, and shape thin dentinal walls, which can result in cervical fracture. An extraction or fracture will present a restorative and esthetic problem, especially if it is a young patient, due to the fact that the bone is too immature for an implant. Apexogenesis, apexification, and regenerative endodontics are exciting techniques in dentistry today. Knowledge in pulp biology, intracanal medicaments, and dental trauma lays the framework in which these procedures should be understood in order to perform them properly and successfully.

Educational objectives

1. Describe the etiological causes for an open apex in permanent teeth
2. Identify challenges that may arise in treating teeth with open apices
3. Demonstrate techniques to treat permanent teeth with immature apices

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The field of dentistry—just like life—is always being challenged and always changing. Our goal as dentists is to maintain the natural dentition of our patients for a lifetime. To reach that goal, we must be aware of all the current technologies at our disposal for the benefit of our patients.

As modern dentists, we are able to utilize revolutionary technology such as 3D CBCT imaging to analyze anatomic structures in real-time. This gives us an advantage in proper treatment planning cases and educating our patients on their current dental conditions. CBCT technology aids us in trauma cases as well, especially in cases with open apices.[1] It also gives us a three-dimensional view of the apex of teeth that may not have developed properly. This breakthrough technology gives us insight into better management of teeth with open apices and several other conditions such as a root fracture[1] (figures 1a-1f). In addition, we have the opportunity to combine CBCT imaging with bioceramic technology such as perforation repair to save teeth that would otherwise have to be extracted[2] (figure 2).

Bioceramics are materials that include alumina, zirconia, bioactive glass, glass ceramics, hydroxyapatite, resorbable calcium phosphates, among other filler particles.[2] They have been used in dentistry for repairing bony defects, root repair, apical retro filling materials, perforation repair, endodontic sealers, and as aids in regenerative procedures. They have certain advantages such as biocompatibility, nontoxicity, dimensional stability, and most importantly in endodontic applications, bioactivity. They are similar to hydroxyapatite, an osteo conductive agent, and have an ability to induce regenerative responses in the human body.[3]

FIGURE 1A: Pre-op radiograph of tooth no. 9 with horizontal root fracture indicated by the red arrow

FIGURE 1B: 3D CBCT image of tooth no. 9 showing a horizontal root fracture indicated by the red arrow

FIGURE 1C: Sagittal view of the 3D CBCT showing the root fracture

FIGURE 1D: Three-year recall shows healing indicated by the green arrow with no endodontic intervention

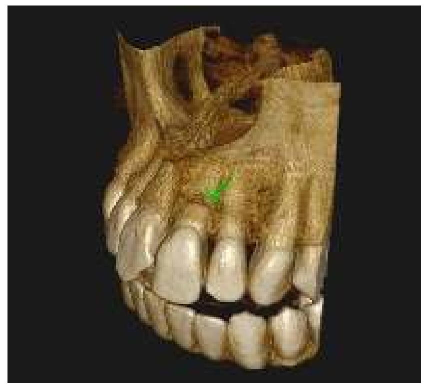

FIGURE 1E: CBCT image shows healing in the fracture area indicated by the green arrow after three-year recall

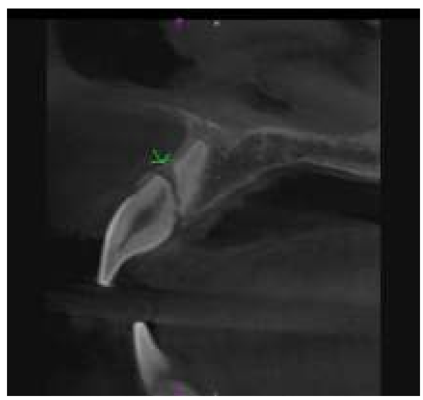

FIGURE 1F: Three-year recall CBCT from a sagittal view shows bone repair of the fracture without any endodontic intervention because the pulp stayed vital

In 1824, Joseph Aspdin patented a product called Portland cement. He obtained it from the calcination of a mixture of limestone coming from Portland, England, and silicon-argillaceous materials.[4] Portland cement is an inexpensive material. Studies show MTA, one of the first bioceramics, has a similar composition. MTA is mineral trioxide aggregate that was invented in the early '90s. It was developed for use as a dental root repair material by Dr. Mahmoud Torabinejad. MTA was originally shipped to various endodontic programs in a 35-mm film container and was considered "top secret."[5]

I was one of the first ones to use the material as an endodontic resident. My first case was a maxillary first molar root canal. While searching for the MB2, I perforated right through the pulpal floor. I was devastated and getting ready to tell the patient

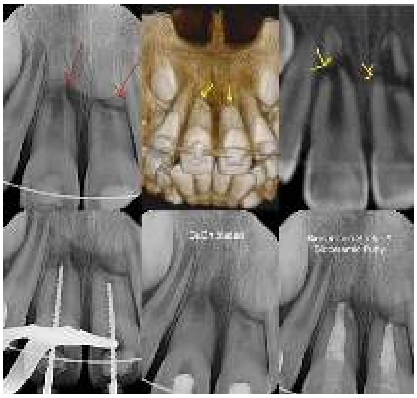

FIGURE 2: Trauma involving teeth nos. 8 and 9. A LFOV 3D CBCT was taken. Endodontic treatment was performed. Bioceramic sealer and bioceramic putty were placed up to the fracture line.

to have the tooth extracted. My program director looked over and said, "Dr. Short, I have something for you to try on that perforation case." He pulled out the original gray MTA from the 35-mm canister. I mixed the material and applied it to the perforation. The patient returned in three months with the bone healed in the furcation area. I was amazed. That was over 20 years ago. Since then, the material color was changed from gray to white MTA for more color stability. White MTA was found to have 54.9% less aluminum sulfate, 56.5% less magnesium oxide, and 90.8% less iron oxide than gray MTA, leading to the conclusion that the iron oxide reduction is most likely the cause for the color change. White MTA was also reported to possess an overall smaller particle size than gray MTA. However, new studies show even the white MTA still caused staining[5] (figures 3a-3g).

MTA is formulated from commercial Portland cement, combined with bismuth oxide powder for radiopacity.[5] MTA is used for creating apical plugs during apexification, repairing root perforations, and treating internal and external resorption. In addition, it can be used for root-end filling material and as pulp capping material. However, one of the major drawbacks is that MTA tends to stain teeth due to the heavy metal bismuth oxide. This can be an issue when using this material on anterior teeth especially.[6]

Over a period of time, MTA started to have a few drawbacks. It was difficult to handle, washed out easily, and could

FIGURE 3A: Pre-op photo of tooth no. 24 with dens evaginatus or a talon's cusp

FIGURE 3B: Pre-op photo of tooth no. 24 with dens evaginatus or a talon's cusp

cause staining in some cases.[7] In 2008, the first premixed bioceramic cement was FDA approved for use as a universal root canal cement.[8] This was soon followed by a thicker, faster-setting, puttylike formulation. This allowed better handling of the material due to its puttylike or Cavit-like consistency.[9] These newer bioceramics were designed to mimic MTA's biocompatibility, while allowing bonding capability, increasing dimensional stability, and having hydrophilic qualities without some of its unnecessary components such as calcium aluminate and bismuth oxide impurities, which caused dentin staining during endodontic clinical use.[10]

What are the causes of open apices?

There are three main ways a permanent tooth can be damaged prior to maturity. They are trauma, caries, and developmental defects such as dens evaginatus.[11] These can create challenges for the clinician on how to properly manage these cases. For instance, open apices can cause the irrigation solution to travel into periradicular tissues, causing a sodium hypochlorite accident.

What are the types of open apices?

There are two types of open apices: blunderbuss and nonblunderbuss. In the

FIGURE 3C: Periapical radiograph of tooth 24 with a large periapical pathology. The diagnosis was a necrotic pulp with chronic apical periodontitis.

FIGURE 3D: Regenerative endodontics was performed on tooth no. 24 using white MTA. A one-year recall shows the pathology getting smaller.

FIGURE 3E: Staining of the white MTA on tooth no. 24 after regeneration

FIGURE 3F: Staining of the white MTA on tooth no. 24 after regeneration

FIGURE 3G: Two-year recall shows the periapical pathology has healed and an apical barrier is forming.

FIGURE 4: Tooth no. 8 had a history of trauma. The pulp became necrotic prior to the apex closing, resulting in a blunderbuss apex.

blunderbuss type, the walls of the canal are divergent and flaring, and the apex is funnel-shaped, oftentimes wider than the coronal aspect of the canal and knife-edged (figure 4). In a nonblunderbuss apex, the walls of the canal may be parallel to slightly convergent. The apex can be broad-shaped or even convergent.[12]

What challenges are faced clinically with an open apex?

Teeth with open apices have thin dentinal walls that are susceptible to fracture. On occasion, they present with periapical pathology, which sometimes can be associated with apical resorption or an abscess. Short roots compromise the crown-root ratio, often affecting long-term prognosis due to less root in the bone for stability. This is very important in children because they are usually more prone to trauma. Complicated crown fractures are common following trauma.[13] In long-standing cases, these teeth may also turn dark, which poses an esthetic concern as well. In addition, large open apices pose a challenge in determining the working length. The paper point technique described by Rosenberg can be helpful to supplement initial apex locator readings.[14] It could be considered for the working length determination of open apices in relatively straight canals. Marcos-Arenal et al. performed an in vivo study, demonstrating an 87% accuracy of this technique in establishing working length to within 0.5 mm of the apical foramen.[15]

Is it necessary to instrument the canal for proper disinfection?

Minimal instrumentation of teeth with open apices and thin dentinal walls is needed. Due to the very thin dentin, overinstrumentation can fracture the root. It is important to use a side-vented syringe very carefully in these cases to minimize a sodium hypochlorite accident. During conventional root canal treatment, the role of instrumentation is to achieve the removal of vital and necrotic tissues from the root canal system, along with infected root dentin.[16]

How do I obturate the canal?

The options for obturation are dependent on whether you decide to create an apical barrier. This procedure is known as apexification. Apexification and other options will be discussed further in this article. In addition, various materials such as bioceramic technology will be used to obturate the canal based on the specific technique used. Calcium silicate-based materials are among the most popular materials used. Calcium silicate has become the preferred obturation material for the management of teeth with open apices because of its ability to act as an osteoconductive apical barrier. Gutta-percha will not be used as the obturation material at the apex in most of the techniques that will be discussed.[17]

Managing the open apex can be very challenging. There are three main procedures to manage the immature apex. They are apexogenesis, apexification, and regeneration. It is critical to understand these procedures and properly select the correct one for a predictable outcome. This article will discuss these various techniques and the materials used to manage the open apex of permanent teeth (figures 5a-5d).

What is apexogenesis?

Apexogenesis is a treatment procedure designed to maintain vital pulp for the root to continue to form and mature. Success is evident by continuous root development to a closed apex. In addition, usually the case will not require endodontic therapy in the future. However, if endodontic therapy is required, the apex would be closed, which would make the endodontic procedure less challenging and more predictable.[18]

Technique: The diagnosis of a vital pulp is most important. This can be confirmed by using a cold test such as Endo-Ice. If it is a case of a complicated crown fracture where the pulp is visible, there is no need for thermal testing to cold. The clinical procedure requires a deep pulpotomy to remove the inflamed tissue. It is advisable, if possible, to perform this procedure with local anesthesia with epinephrine. This will help reduce the bleeding and allow for more visualization. Once the patient is anesthetized, a rubber dam is placed and the tooth is accessed. The diseased or inflamed pulp is removed with a high-speed diamond with copious water as an irrigant. Once inside, make sure all

FIGURE 5A: History of trauma on teeth nos. 8 and 9. Tooth no. 8 had a nonblunderbuss apex. Tooth no. 9 had a closed apex but there was calcification present.

FIGURE 5B: Coronal CBCT view of teeth nos. 8 and 9 further demonstrating the defects

the decay is removed very carefully. This can be done with a slow-speed round bur or spoon excavator. Bleeding of the pulp can be controlled with saline-soaked cotton pellets, local anesthetic with 1:100,000 epi-soaked cotton pellets, or NaOCl-soaked cotton pellets with slight pressure. The pulp dressing is then covered with a calcium silicate material. Some studies show MTA can stain the tooth after a period of time. Today, materials such as bioceramic putty or biodentine do not contain the heavy metal bismuth oxide, which prevents staining. It is important to have at least 3 mm of bioceramic material over the pulp to ensure the setting and protection of the pulp. After the bioceramic material is placed over the pulp, the tooth can be immediately restored. These cases should be followed up in six months, one year, and three years. The apex should be closed in three years[18] (figure 6).

FIGURE 5C: Endodontic treatment was completed in one visit on tooth no. 8 using bioceramic sealer and bioceramic putty. Tooth no. 9 had the gutta-percha cone fit.

FIGURE 5D: Endodontic treatment was completed on tooth no. 9 using gutta percha and bioceramic sealer.

What is apexification?

Apexification is a treatment used when the pulp has become necrotic before the apex had a chance to mature or close. These cases usually have a blunderbuss apex, and occasionally the patient will present with swelling and/or a sinus tract. One major drawback of apexification is that there is no continued root development. This can cause the root to be weaker and more susceptible to fracture.[19]

Technique: The diagnosis of this case must be a necrotic pulp. Cold testing can confirm this as well as electric pulp testing. The tooth is anesthetized with a local anesthetic (with or without epinephrine).

FIGURE 6: Apexogenesis was performed with white MTA. A 1.5 year recall shows the apex is closing. A 2.5 year recall shows the apex is completely closed.

A rubber dam is placed. The tooth is accessed, instrumented very lightly with large hand files, and irrigated lightly with sodium hypochlorite. The canal is dried, and calcium hydroxide is placed inside the canal for one month. The calcium hydroxide placed is usually USP or powder calcium hydroxide that is mixed with anesthetic to a wet sandlike consistency, and then placed inside the canal. An amalgam carrier usually works very well. A premixed calcium hydroxide paste can be used, but it's difficult to control with an open apex. The tooth is closed with a temporary material. The patient returns in one month to make sure there are no signs of infection and that the calcium hydroxide did not wash out. If the calcium hydroxide has disappeared or washed out, it should be repacked once again and a temporary should be placed. Have the patient return in three months for another evaluation. These steps are repeated until a calcific bridge has formed at the apex (this may take three to six months). Once the calcific bridge has formed, the tooth can be obturated with sealer and gutta-percha (figure 7).

Immediate apexification is another procedure that can be used for an open apex with a necrotic pulp. The initial procedure is the same technique as described above. However, once the canal is adequately cleaned and dried, a resorbable membrane can be placed at the apex. This will behave as an apical stop to allow the calcium silicate material to be contained in the root (make sure there is 3 to 5 mm of material placed). Then sealer and gutta-percha (and

FIGURE 7: Endodontic apexification procedure was performed on tooth no. 8. A calcific bridge was formed and case was obturated with white MTA and a composite restoration was placed.

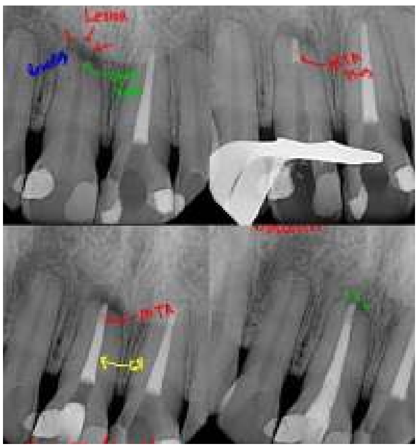

FIGURE 8: Immediate apexification was performed on tooth no. 8. An MTA plug was placed with white MTA at the apex. A six-month recall shows nice healing at the apex.

post if necessary) can be placed on top of the calcium silicate material until final restoration, which could be performed immediately. Six-month and one-year recalls are recommended to be sure the apex is closed or is in the process of closing (figure 8).[20]

What is regeneration?

Regeneration is the process of the pulp "revitalizing" or "regenerating" new tissue so that root maturation can occur in absence of disease. The patient's tooth can then return to function, form, and esthetics. Regeneration should be considered when a tooth has a necrotic pulp and an open apex. Usually, these patients are young and the root canal has a very thin dentinal wall. Very often these patients present with periapical pathology.[21]

FIGURE 9A: Pre-op photo of tooth no. 20 showing dens evaginatus with the enamel tip chipping, causing the tooth to become necrotic prior to the apex forming

FIGURE 9B: Pre-op photo of tooth no. 20 showing dens evaginatus with the enamel tip chipping, causing the tooth to become necrotic prior to the apex forming

Technique: In order to perform regeneration, the diagnosis must be a necrotic pulp and an open apex. The tooth is anesthetized with local anesthesia (with or without epinephrine). The tooth is isolated with a rubber dam and accessed. Copious gentle irrigation is performed with 3% sodium hypochlorite with a side-vented syringe 5 mm from the apex to help reduce a sodium hypochlorite accident. The canal is then rinsed with sterile saline. The canal is irrigated with 2% chlorhexidine gluconate with a side-vented syringe. The canal is dried with a large paper point. Calcium hydroxide USP or paste is placed inside the canal. The canal is sealed with a cotton pellet and a temporary restoration. The patient is dismissed for three to four weeks.

FIGURE 9C: Pre-op radiograph of tooth no. 20 with an open apex and the enamel tip chipped off

FIGURE 9D: Post-op radiograph with the initiation of the regeneration procedure with calcium hydroxide USP placed with Cavit

FIGURE 9E: Patient returned one year later after the regenerative endodontic procedure was performed with biocramic putty

FIGURE 9F: Three-year recall of tooth no. 20 showing the apex has fully closed after regenerative endodontic therapy

FIGURE 9G: Post-op photo showing no color change after three years since the regenerative endodontic procedure was performed with bioceramic putty

FIGURE 9H: Post-op photo showing no color change after three years since the regenerative endodontic procedure was performed with bioceramic putty

The patient returns asymptomatic with no signs of pathology. The patient is then anesthetized with local anesthetic without epinephrine. It is important to use mepivacaine on the follow-up visit so a blood clot can form during the procedure. The tooth is isolated with a rubber dam and accessed. Copious and gentle irrigation is performed with 17% EDTA followed by sterile saline. The canal is dried with a large paper point. Bleeding is then created with a file going beyond the apex to form a blood clot that comes back through the canal space. Then 3 to 4 mm of calcium silicate material such as bioceramic putty or biodentine is carefully placed on top of the blood clot. A resorbable membrane can also be used as a matrix prior to the placement of the bioceramic putty. This will provide something to pack the calcium silicate material against. This material needs to be only 3 to 4 mm in the canal space. The tooth is then restored with a restoration material such as a composite.

The patient's first follow-up is one month. The tooth should be asymptomatic and functional. The next follow-up should be six months, and then one year. Studies show it can take up to 24 months to see evidence of increased dentinal wall thickness and increased root length[21] (figures 9a-9h).

Discussion

Patients who present with immature apical formation pose a challenge due to the presence of large open apices along with divergent and thin dentinal walls that are susceptible to fracture. Historically, we have tried to generate the formation of an apical barrier by repeated placement of calcium hydroxide over many months, or more recently by immediate barrier formation with a mineral trioxide aggregate (MTA) plug. There are some studies that show long-term use of calcium hydroxide can weaken the dentin. This can cause the tooth to fracture.[22] Studies show that an assessment of the composition of regenerated tissue via apexogenesis has proven to be difficult, and it seems that it is made up of periodontal and bone tissue rather than tissue of pulpal origin.[23]

A smaller particle size formulation was designed to allow improved delivery of bioceramics and expand its use from surgical repair materials into the realm of nonsurgical root canal therapy as an obturation cement and a filler. The improved clinical handling properties due to their premix nature, and no dentin staining due to the absence of bismuth oxide, are the main advantages of these products over MTA.[24]

Conclusion

There have been significant changes in the clinical management of infected immature permanent teeth dating back to the 1960s by Ostby. Then, in the 2000s, Banchs and Trope reported an alternative treatment to revascularization by introducing the use of triple antibiotic pastes.[18] Triple antibiotic paste (TAP) contains metronidazole, ciprofloxacin, and minocycline. However, it is expensive and cumbersome to get these pastes made by a pharmacy and to have them ready for patients on demand. Many studies show calcium hydroxide can give the same results instead. It can be used as the intracanal medicament and reduce the incidence of allergic reactions to the antibiotics. In addition, minocycline has been known to stain teeth as well. Triple antibiotic pastes have to be used with caution, especially on anterior teeth, due to possible staining creating an esthetic concern, just like with MTA.[25]

Like all dental procedures, these techniques are subject to change as more research and case studies are published, including better materials and technology. Knowledge in pulp biology, intracanal medicaments, and dental trauma lays the framework in which this procedure should be understood in order to perform it properly and successfully.

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QUESTIONS

1. CBCT technology aids in which item in endodontics?
   A. Trauma
   B. Root fractures
   C. Incomplete apex
   D. All of the above

2. Bioceramics are made of which material?
   A. Alumina
   B. Zirconia
   C. Bioactive glass
   D. All of the above

3. What are bioceramics used for?
   A. Root repair
   B. Apico retrofill
   C. Repairing bony defects
   D. All of the above

4. Who patented Portland cement?
   A. James Brown
   B. Joseph Aspdin
   C. Mike Anew
   D. Jeff Simms

5. MTA was invented in what time span?
   A. Early ’70s
   B. Late ’90s
   C. Early ’90s
   D. Mid 2000s

6. Who invented MTA?
   A. Trent Jones
   B. Terrance Vandiver
   C. Mahmoud Torabinejad
   D. Angela Maralago

7. What was the original color of MTA?
   A. White
   B. Gray
   C. Green
   D. Blue

8. What is the use for MTA?
   A. Apical plugs
   B. Root repair
   C. Treating resorption
   D. All of the above

9. What ingredient in MTA is the culprit for staining?
   A. Bismuth oxide
   B. Calcium aluminate
   C. Iron oxide
   D. None of the above

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QUESTIONS

10. What is the cause for open apices?
    A. Trauma
    B. Caries
    C. Developmental defects
    D. All of the above

11. What is a type of open apex?
    A. Blunderbuss
    B. Nonblunderbuss
    C. Narrowbuss
    D. Both A and B

12. Who described the paper point technique to supplement apex locator readings?
    A. Schwartz
    B. Rosenberg
    C. Skidmore
    D. Dorn

13. How accurate is the paper point technique in establishing the working length?
    A. 20%
    B. 50%
    C. 87%
    D. 95%

14. What are the procedures used to manage the open apex?
    A. Apexogenesis
    B. Apexification
    C. Regeneration
    D. All of the above

15. Which bioceramic material will not usually stain the tooth?
    A. Bioceramic putty
    B. Biodentine
    C. MTA
    D. Both A and B

16. How often should a follow-up be performed after apexogenesis?
    A. 6 months
    B. 1 year
    C. 3 years
    D. All of the above

17. What is a major drawback of apexification?
    A. No continued root development
    B. Weaker root
    C. Root more fracture prone
    D. All of the above

18. What is the benefit of regeneration?
    A. The tooth can return to function.
    B. The tooth can return to form.
    C. The tooth can still be esthetic.
    D. All of the above

19. What percentage of sodium hypochlorite is advisable to use with regeneration?
    A. 40%
    B. 20%
    C. 3%
    D. 30%

20. How long can it take to see evidence of increased dentinal wall thickness and increased root length?
    A. 3 months
    B. 6 months
    C. 9 months
    D. 24 months

21. What is a major drawback of long-term use of calcium hydroxide?
    A. It can weaken the dentin.
    B. It can make the tooth darker.
    C. It can make the tooth lighter.
    D. None of the above

22. Who was one of the first people to create a protocol to manage infected immature permanent teeth?
    A. Otsby
    B. Dorn
    C. Trope
    D. Banchs

23. Which is a component of triple antibiotics paste?
    A. Metronidazole
    B. Ciprofloxacin
    C. Minocycline
    D. All of the above

24. Which antibiotic is known to stain teeth?
    A. Minocycline
    B. Penicillin
    C. Ciprofloxacin
    D. Azithromycin

25. CBCT technology can be combined with what material in order to save teeth?
    A. Bioceramic putty
    B. MTA
    C. Both A and B
    D. None of the above

26. Which is an advantage of using bioceramic materials in endodontics?
    A. Biocompatible
    B. Nontoxic
    C. Dimensional stability
    D. All of the above

27. How expensive is Portland cement?
    A. Very expensive
    B. Inexpensive
    C. Moderately expensive
    D. None of the above

28. What ingredient in MTA is the radiopacity agent?
    A. Bismuth oxide powder
    B. Aluminum silicate
    C. Magnesium oxide
    D. None of the above

29. Which teeth can be a major issue when using MTA due to staining?
    A. Incisors
    B. Premolars
    C. Molars
    D. All of the above

30. In what year was the first premixed bioceramic cement approved by the FDA?
    A. 1998
    B. 2000
    C. 2020
    D. 2008

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EXPIRATION DATE:	JULY 2024

ANSWER SHEET

Managing the immature apex in permanent teeth

NAME: ______ TITLE: ______ SPECIALTY: ______

ADDRESS: ______ EMAIL: ______ AGD MEMBER ID (IF APPLIES): ______

CITY: ______ STATE: ______ ZIP: ______ COUNTRY: ______

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Educational Objectives

1. Describe the etiological causes for an open apex in permanent teeth
2. Identify challenges that may arise in treating teeth with open apices
3. Demonstrate techniques to treat permanent teeth with immature apices

Course Evaluation

1. Were the individual course objectives met?

   Objective #1: Yes No   Objective #2: Yes No   Objective #3: Yes No

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

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 objectives and educational methods?	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 author'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 references.	5	4	3	2	1	0
10. Do you feel that the references were adequate?	Yes	No				
11. Would you take a similar course 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 dental continuing education topics would you like to see?

______

______

______

Mail/fax completed answer sheet to:

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5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

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