

Earn

4 CE credits

This course was written for dentists, dental hygienists, and assistants.



Principles of Intraoral Imaging

A Peer-Reviewed Publication
Written by Dr. Thomas Schiff

ADA CERP

Continuing Education
Recognition Program

PennWell is an ADA CERP recognized provider

ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.

Concerns of complaints about a CE provider may be directed to the provider or to ADA CERP at www.ada.org/goto/cerp.

PennWell®

dental
CE
digest

inneedce.com
The Academy of Dental
Therapeutics and Stomatology™

Go Green, Go Online to take your course

This course has been made possible through an unrestricted educational grant. The cost of this CE course is \$59.00 for 4 CE credits.

Cancellation/Refund Policy: Any participant who is not 100% satisfied with this course can request a full refund by contacting PennWell in writing.

Educational Objectives

Upon completion of this course, the clinician will be able to do the following:

1. Accurately image teeth, bone, and restorations.
2. Understand the principles of radiation.
3. Understand the principles of imaging geometry.
4. Comprehend the utilization of a positioning system.

Abstract

The use of intraoral imaging is essential to visualize teeth and surrounding bony structure alike. It must be emphasized that first a medical history should be updated or completed and then be followed by a detailed clinical examination. Frequency of imaging should be based upon individual patient examinations and history of disease.

History of Radiology

Ever since Wilhelm Konrad Roentgen discovered X-rays in November 1895, there has been the desire to harness this energy to better serve dental patients through visualization of the anatomy and its associated pathology. Less than two weeks after this important discovery, Dr. Otto Walkhoff developed the original dental “roentgenogram” from a portion of a glass imaging plate. The image required 25 minutes of exposure time.

Since their discovery, creating X-rays has not been much of a technical limitation; containing the X-rays, and limiting patient exposure to ionizing radiation have always been the difficulties.

Dr. Edmund Kells Jr., an early X-ray pioneer, considered the first person in North America to develop dental radiographs, was the first to note problems associated with the use of X-rays.

He reported that long exposures caused mild skin irritations similar to sunburn. After 12 years of nearly constant exposure, Kells developed cancerous tumors on his hands. Like many of his peers, he would endure many operations and lost successively his fingers, hand, arm, and shoulder from exposure to X-rays. (At age 72, Kells committed suicide.) By 1904, most professionals acknowledged X-rays’ ability to kill as well as to heal.

Dr. Frank Van Woert later pioneered the use of Kodak film instead of glass imaging plates to capture images. This improved patient comfort and reduced exposure times. By 1955, Kodak developed D-speed radiographic film. In 1981, Kodak introduced E-speed film, which reduced exposure times by 50 percent. Most recently in 2001, F-speed film became available; this switch from E to F-speed resulted in a 20–25 percent reduction in exposure time. Each step along the path of history has been marked with milestones toward providing superior diagnostic images, using less radiation, and delivering greater patient comfort.

Introduction

In dental practice, the use of radiology can be categorized into two subgroups, intra- and extraoral imaging. The category of intraoral imaging involves viewing teeth and surrounding structures on receptors, such as film, placed into the oral cavity. There are three sizes of film used primarily for this purpose:

- Size 0 for pediatric imaging
- Size 1 for anterior imaging
- Size 2 for posterior imaging

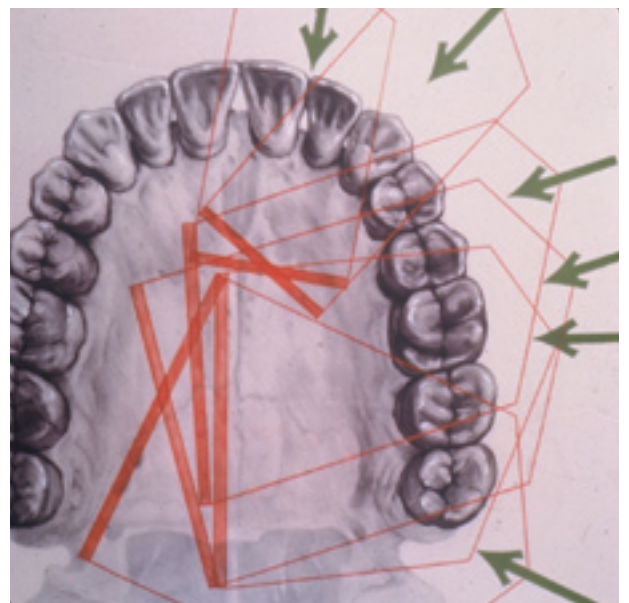
The film sizes should be alternated by the user as necessary to ensure patient comfort. Extraoral films are used for imaging the entire head of a patient or parts of it on a receptor placed outside of the patient.

Intraoral Imaging

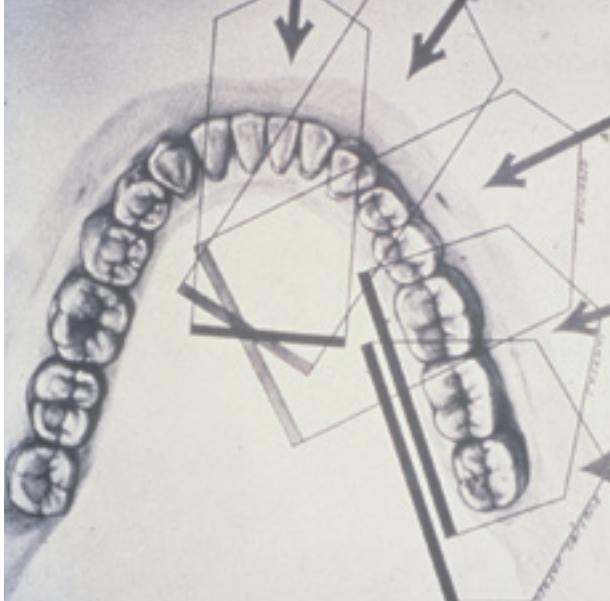
The purpose of intraoral imaging is to establish images that are nearly identical to the objects we are imaging. To accomplish this, we have to understand the principles of geometry.

- A. The object and the image receptor (film) need to be parallel with each other.
- B. The central beam must be positioned at a 90-degree angle to both the object and the film.
- C. The object should be as far away from the source of radiation as practical.
- D. The film should be as close to the object being imaged as possible.

To follow these principles, we have to understand that freehand positioning of a radiographic film will not result in accurate imaging. Accomplishing accuracy requires the utilization of a positioning system. A positioning device ensures parallelism between film and object.



The problem is how to position this device in the oral cavity. To simplify the explanation, the following samples walk you through the oral cavity and different positionings for different teeth. As you can see, all films are placed in the midline of the maxilla for both anterior and posterior imaging. The mandible shows the same positioning; however, note that the mandibular molar exposure allows the placement of the film close to the teeth, in the space provided between the tongue and the teeth.

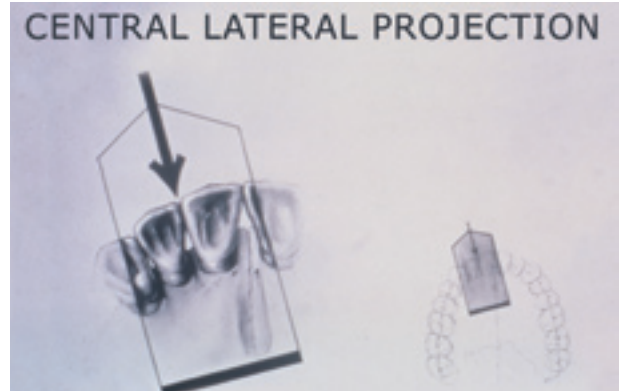


Positioning

Periapical radiographs ensure that both the teeth and surrounding structures are clearly visible, while the need for bitewing radiographs is to show the interproximal area of the coronal portions of teeth, giving a clear view of formation of interproximal pathology, primarily caries. Bitewing radiographs are also used to judge the level of bone and its relationship to the cemento-enamel junction. Both periapical films and bitewing films should be parallel to the long axis of teeth being imaged.

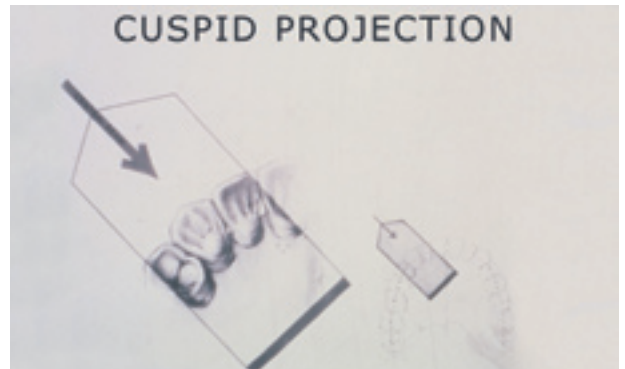
Maxillary centrals and laterals exposure

The film is placed as far lingually as possible, ensuring that the primary beam of the X-ray is pointed between the central and lateral incisors.



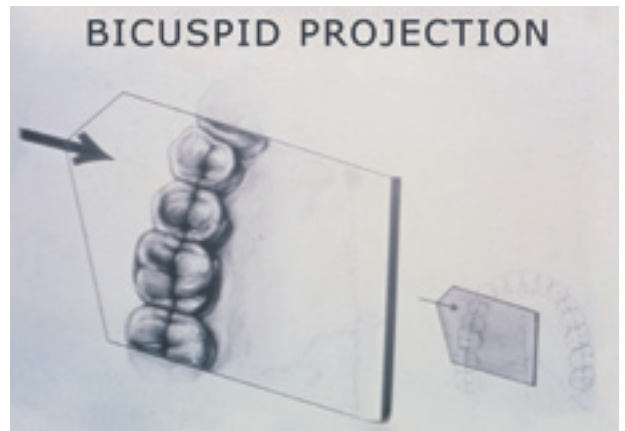
Maxillary canine exposure:

This is one of the difficult exposures to accomplish, since the canine is at the curvature of the arch. We have to choose either the mesial or the distal aspect of this tooth to show up clearly. It is easiest to place the film as far into the oral cavity as possible and direct the central beam to pass through the embrasure between the lateral and the cuspid. The distal interproximal area will be imaged on the bicuspid exposure.



Maxillary bicuspid exposure

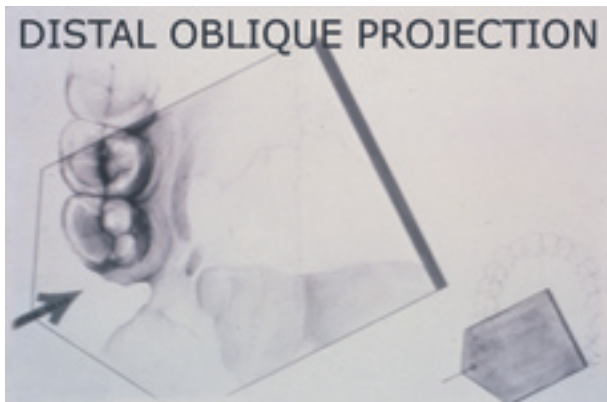
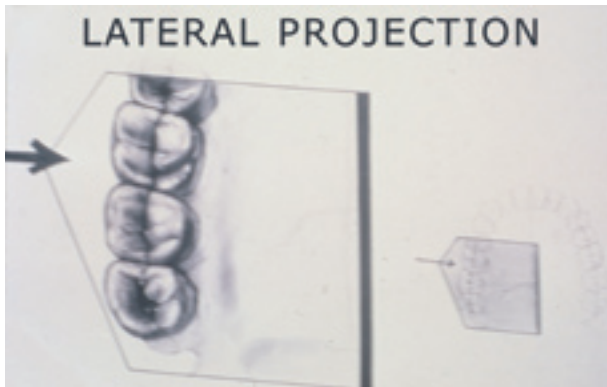
This exposure is difficult to imagine because the film is now in the midline of the palate and the anterior portion of the film is actually pointing toward the canine of the contralateral side, while the central beam is directed through the inter-proximal region between the canine



and first premolar teeth. The same principle will apply for the bitewing film of the bicuspid region (it will be discussed later).

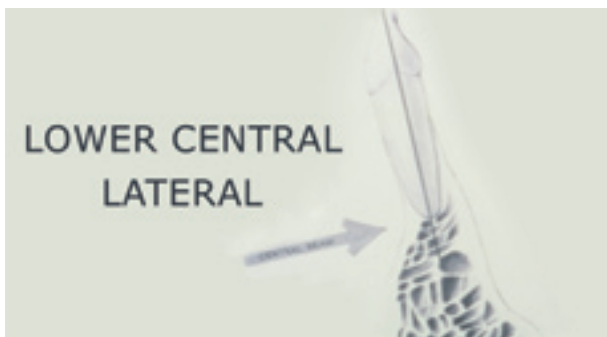
Maxillary molar exposure

The film is positioned into the middle of the arch, ensuring that the central beam will come under the zygomatic arch. Special distal positioning will be done on some selected third-molar exposures when the distal end of the film will be positioned to point toward the uvula, thus obtaining an exposure where the central beam will be coming from the posterior to the anterior region, looking almost as though it comes from the ear forward (see resulting picture).



Mandibular central incisor exposure

The mandibular central incisors are a bit difficult because we have to again place the film as far lingually as possible.



This ideally requires positioning the film on the dorsum of the tongue (i.e., on top of the tongue).

Ensure that you do not tell the patient that the film is placed on the tongue, because the patient will then try to assist you by continuously moving his or her tongue.

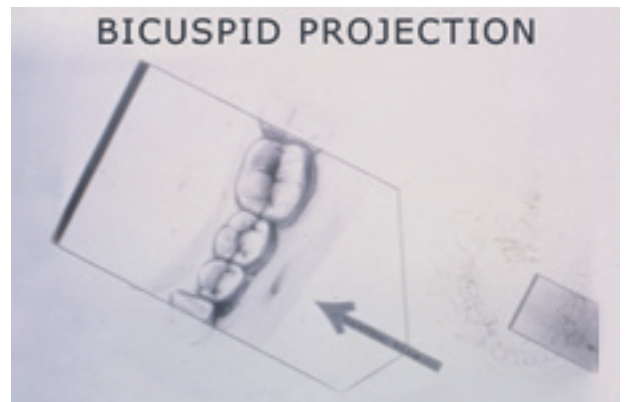
Mandibular cuspid exposure

This image is almost as difficult as that of the maxillary cuspid because of the film's placement in the curvature of the mouth. Again the central beam must be directed between the lateral incisor and the cuspid (the distal end of the cuspid will be imaged at the bicuspid exposure).



Mandibular bicuspid exposure

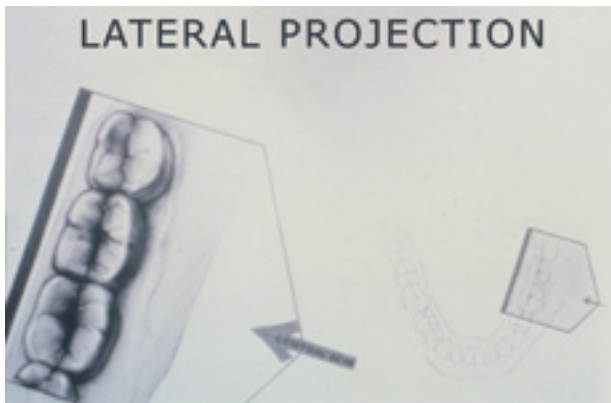
Just as for the maxillary exposure, imaging the mandibular bicuspid requires the angulation of the film to be pointing from the canine of the contralateral side. The anterior end of the film will point to the canine of the opposite side.



Mandibular molar exposure

This exposure is the only exposure where the film is placed adjacent to the teeth in the space between the tongue and the teeth.

All exposures of the whole intraoral series should be made with a positive angle of exposure. The cone is



placed in a positive angle pointing down; the exception is the lower anterior teeth, where the angle is negative (the cone points up because of the flaring of the anterior teeth). The degree of this angulation is determined by the patient's anatomy.

Bitewing Radiographs

There are two sets of bitewing radiographs for all patients- bicuspid and molar bitewings. Both a positioning device and adhesive bitewing tabs may be used for these types of exposures.

- A. The bicuspid bitewing positioning is the same as that of the bicuspid exposure (utilizing an angle such that the anterior part of the film is positioned toward the canine of the other side).
- B. The molar bitewing is placed close to the teeth, and the angulation is approximately plus five degrees.



Bitewing films should be taken using a positioning device. Freehand bitewings can also be made using the adhesive bitewing tab technique.

The maxillary and the mandibular tori should be treated with care. All maxillary tori should be placed between the teeth and the film to ensure that a flat angulation picture attaches. Mandibular tori present a sensitivity problem. Try to stay away from them as much as possible.

Conclusion

The use of intraoral imaging is essential to visualize teeth and surrounding bony structure alike. It must be emphasized that first a medical history should be updated or completed and then be followed by a detailed clinical examination. It must also be stressed that imaging should only be done when ordered by the dental professional. There should be "no "routine" radiographs." Frequency of imaging should be based upon individual patient examinations and history of disease. Today's recommendation, however, indicates full mouth imaging at every five-year interval.

References

- Abbott, Paul, "Are Dental Radiographs Safe?" *Australian Dental Journal*, 45:(3):208-213, 2000
- McElfish, Dr. Charles, "C. Edmund Kells Pioneered Electricity and Dental X-rays"
- Langlais, Dr. Robert, *Oral Radiology and Interpretation* (fourth edition)
- Haring & Jansen, *Dental Radiography* (Saunders, 2nd edition)
- Langland & Langlais, *Principles of Dental Imaging* (Williams & Wilkins)

Author Profile

Dr. Thomas Schiff



Dr. Schiff was born in Budapest, Hungary, (before the Second World War) and educated at the Semmelweis University Medical School until the Hungarian uprising in 1956. He then immigrated to the United States and furthered his education at the University of Alabama School of

Dentistry. He received a DMD degree in 1961. He practiced and did research at the Monsanto Chemical Company for 19 years. Afterwards he entered into academia and since has been teaching radiology.

Dr. Schiff was trained in advanced radiology at the University of Texas Health Science Center at San Antonio. At present, he is the endowed professor and chair of maxillofacial radiology at University of the Pacific Arthur A. Dugoni School of Dentistry.

Disclaimer

The author of this course has no commercial ties with the sponsors or the providers of the unrestricted educational grant for this course.

Reader Feedback

We encourage your comments on this or any PennWell course. For your convenience, an online feedback form is available at www.ineedce.com.

Questions

- Who is credited with discovering X-rays?
 - William Walkhoff
 - Conrad Anderson
 - Wilhelm Konrad Roentgen
 - John Eastman
- In what month and year were X-rays discovered?
 - November 1895
 - December 1896
 - November 1894
 - December 1895
- What did Dr. Otto Walkhoff develop?
 - The walknogram
 - The roentgenogram
 - The grammophone
 - none of the above
- What type of plate did the roentgenogram use?
 - Metal
 - Wood
 - Glass
 - none of the above
- What was the exposure time for the roentgenogram?
 - 25 minutes
 - 35 minutes
 - 15 minutes
 - 5 minutes
- Who developed the first dental radiographs?
 - Edmund Hillary Jr.
 - Edmond Kells Jr.
 - Wilhelm Konrad Roentgen
 - none of the above
- Who pioneered the use of film instead of glass plates?
 - Frank Van Woert
 - Frank L. Wright
 - Edmond Kells Jr.
 - none of the above
- What were the initial advantages of films over imaging plates?
 - Improved patient comfort
 - Reduced exposure times
 - both a and b
 - none of the above
- At what age did Dr. Kells die?
 - 70
 - 71
 - 72
 - 73
- In what year was D-speed radiographic film developed?
 - 1952
 - 1953
 - 1954
 - 1955
- In what year was E-speed film developed?
 - 1981
 - 1979
 - 1982
 - 1985
- E-speed film reduced exposure time by what percentage?
 - 45%
 - 50%
 - 55%
 - 60%
- What are the two subgroup categories in dental radiology?
 - Intra- and extraoral
 - Lingual and intraoral
 - Buccal and lingual
 - Distal and lingual
- The category of intraoral imaging involves viewing teeth and surrounding structures on receptors placed into the oral cavity.
 - True
 - False
- What are the three film sizes used in intraoral imaging?
 - 3, 4, 5
 - 1, 2, 3
 - 0, 1, 2
 - none of the above
- Extraoral film is for imaging the entire head or parts of it on a receptor plate outside of the patient.
 - True
 - False
- The purpose of intraoral imaging is to establish images that are nearly identical to objects being imaged or X-rayed.
 - True
 - False
- Freehand positioning of film will result in accurate imaging.
 - True
 - False
- In intraoral imaging, the film should be _____ the object being imaged.
 - Far from
 - Close to
 - Below
 - none of the above
- What should be used to ensure parallelism between film and object?
 - A cotton roll
 - A bite stick
 - A positioning device
 - none of the above
- All films are placed in the midline of the maxilla for both anterior and posterior imaging.
 - True
 - False
- For maxillary centrals and laterals, where should the film be placed?
 - As far buccally as possible
 - Distal to the molars
 - As far lingually as possible
 - none of the above
- Why is the maxillary canine a difficult exposure?
 - Because of the confined space
 - Because of the curvature of the arch
 - Because of the film size
 - none of the above
- For a maxillary bicuspid exposure, where should the film be placed?
 - In the middle of the mouth
 - Under the tongue
 - both a and b
 - none of the above
- Why should a patient not be told that film is being placed on his or her tongue?
 - The patient will attempt to masticate.
 - The patient will gag.
 - The patient will try to assist and continuously move his or her tongue.
 - none of the above.
- Where should the central beam be directed for the mandibular cuspid exposure?
 - Between the lateral incisor and the cuspid
 - Between the first molar and the third molar
 - Between the lateral incisor and the second molar
 - none of the above
- Which exposure is the only one where the film is placed adjacent to the teeth, in the space between the tongue and the teeth?
 - Mandibular bicuspid
 - Mandibular cuspid
 - Mandibular molar
 - all of the above
- How many sets of bitewing radiographs are there?
 - One
 - Two
 - Three
 - Four
- Should a positioning device be used for bitewing exposures?
 - Yes
 - No
- What is the approximate angulation on a molar bitewing?
 - Two degrees
 - Three degrees
 - Four degrees
 - Five degrees

Principles of Intraoral Imaging

Name: _____ Title: _____ Specialty: _____

Address: _____ E-mail: _____

City: _____ State: _____ ZIP: _____

Telephone: Home () _____ Office () _____

Requirements for successful completion of the course and to obtain dental continuing education credits: 1) Read the entire course. 2) Complete all information above. 3) Complete answer sheets in either pen or pencil. 4) Mark only one answer for each question. 5) A score of 70% on this test will earn you 4 CE credits. 6) Complete the Course Evaluation below. 7) Make check payable to PennWell Corp.

Educational Objectives

1. Accurately image teeth, bone, and restorations.
2. Understand the principles of radiation.
3. Understand the principles of imaging geometry.
4. Comprehend the utilization of a positioning system.

Course Evaluation

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 #3: Yes	No		
	Objective #2: 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 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 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. Do you feel that the references were adequate?		Yes		No		
9. Would you participate in a similar program on a different topic?		Yes		No		
10. If any of the continuing education questions were unclear or ambiguous, please list them.	_____					

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

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

Mail completed answer sheet to

Academy of Dental Therapeutics and Stomatology, A Division of PennWell Corp.

P.O. Box 116, Chesterland, OH 44026
or fax to: (440) 845-3447

For IMMEDIATE results, go to www.inedce.com and click on the button "Take Tests Online." Answer sheets can be faxed with credit card payment to (440) 845-3447, (216) 398-7922, or (216) 255-6619.

Payment of \$59.00 is enclosed.
(Checks and credit cards are accepted.)

If paying by credit card, please complete the following: MC Visa AmEx Discover

Acct. Number: _____

Exp. Date: _____

Charges on your statement will show up as Pennwell

- | | |
|---|---|
| 1. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 16. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 2. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 17. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 3. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 18. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 4. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 19. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 5. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 20. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 6. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 21. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 7. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 22. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 8. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 23. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 9. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 24. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 10. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 25. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 11. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 26. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 12. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 27. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 13. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 28. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 14. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 29. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |
| 15. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D | 30. <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D |

AGD Code 731

PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.

AUTHOR DISCLAIMER

The author of this course has no commercial ties with the sponsors or the providers of the unrestricted educational grant for this course.

SPONSOR/PROVIDER

This course was made possible through an unrestricted educational grant. No manufacturer or third party has had any input into the development of course content. All content has been derived from references listed, and/or the opinions of clinicians. Please direct all questions pertaining to PennWell or the administration of this course to Machele Galloway, 1421 S. Sheridan Rd., Tulsa, OK 74112 or macheleg@pennwell.com.

COURSE EVALUATION and PARTICIPANT FEEDBACK

We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included with the course. Please e-mail all questions to: macheleg@pennwell.com.

INSTRUCTIONS

All questions should have only one answer. Grading of this examination is done manually. Participants will receive confirmation of passing by receipt of a verification form. Verification forms will be mailed within two weeks after taking an examination.

EDUCATIONAL DISCLAIMER

The opinions of efficacy or perceived value of any products or companies mentioned in this course and expressed herein are those of the author(s) of the course and do not necessarily reflect those of PennWell.

Completing a single continuing education course does not provide enough information to give the participant the feeling that s/he is an expert in the field related to the course topic. It is a combination of many educational courses and clinical experience that allows the participant to develop skills and expertise.

COURSE CREDITS/COST

All participants scoring at least 70% (answering 21 or more questions correctly) on the examination will receive a verification form verifying 4 CE credits. The formal continuing education program of this sponsor is accepted by the AGD for Fellowship/Membership credit. Please contact PennWell for current term of acceptance. Participants are urged to contact their state dental boards for continuing education requirements. PennWell is a California Provider. The California Provider number is 3274. The cost for courses ranges from \$49.00 to \$110.00.

Many PennWell self-study courses have been approved by the Dental Assisting National Board, Inc. (DANB) and can be used by dental assistants who are DANB certified to meet DANB's annual continuing education requirements. To find out if this course or any other PennWell course has been approved by DANB, please contact DANB's Recertification Department at 1-800-FOR-DANB, ext. 445.

RECORD KEEPING

PennWell maintains records of your successful completion of any exam. Please contact our offices for a copy of your continuing education credits report. This report, which will list all credits earned to date, will be generated and mailed to you within five business days of receipt.

CANCELLATION/REFUND POLICY

Any participant who is not 100% satisfied with this course can request a full refund by contacting PennWell in writing.

© 2008 by the Academy of Dental Therapeutics and Stomatology, a division of PennWell