Interdental Cleaning
A Peer-Reviewed Publication
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Educational Objectives
Upon completion of this course, the clinician will be able to do the following:
1. Discuss the current status of caries, gingivitis, and periodontal disease in the United States
2. List the dental implications associated with inadequate/ineffective interdental plaque control
3. Recognize the clinical signs of infrequent interdental plaque control and identify patients who are at a high risk for periodontal diseases
4. Recommend appropriate interdental cleaning methods and devices for specific patient needs, and explain the necessity of interdental plaque control as part of the patient’s complete self-care program

Abstract
Interdental plaque control is essential to every patient’s self-care program. Bacteria have a causal relationship in the etiology of caries and periodontal disease. Excellent oral hygiene is necessary to remove dental plaque to prevent oral disease, and clinical examination should include an assessment of plaque levels interdentally as well as a review of diet, risk factors and medical history. It has been shown that toothbrushes are relatively ineffective interdentally, and it is also known that periodontal disease typically begins interstitially. Toothbrushing alone cannot remove plaque between tooth surfaces and adjacent gingiva. It is also known that only a minority of patients are compliant flossers.\(^1\) In one survey, more than half of respondents indicated that the majority of their patients (70 percent to 80 percent) did not floss daily.\(^2\) Amongst implant patients—a patient population for whom flossing has been particularly stressed—few floss.\(^3\) Several dental conditions result from infrequent or ineffective interdental cleaning, including caries and periodontal diseases. These two, in combination, suggest a need for effective interdental cleaning. Ongoing patient education is also an integral part of patient compliance. While most patients brush at least for a short period of time, fewer use interdental devices. Adjunctive aids, including interdental brushes, floss, and mechanical devices, are available to remove interdental plaque. Clinical studies have shown that manual interdental brushes are particularly effective at reducing plaque and gingivitis. Selecting with the patient the sizes and types of interdental device(s) that are best for him or her includes an assessment of the interdental space; contact points; retentive areas; gingival shape, position, and pockets; and patient demonstration to help motivate them and increase the likelihood of effective interdental cleaning. Ultimately, the goal of patient care is to prevent, arrest or control periodontal disease and/or caries. The patient’s ability to remove plaque effectively and thoroughly is essential to every patient’s self-care program.

Introduction
Interdental plaque control is an essential part of every patient’s self-care program. Toothbrushing alone cannot remove plaque between tooth surfaces and adjacent gingiva,\(^4\) and many patients are noncompliant. Dental conditions resulting from infrequent or ineffective interdental cleaning include caries, gingivitis and periodontal diseases.

Prevalence of Caries, Gingivitis, and Periodontal Disease
Caries
The National Health and Nutrition Examination Survey (NHANES) documents improvements in the oral health of the U.S. civilian population. The decline in the prevalence and severity of dental caries in permanent teeth, reported in previous national surveys, continued from 1988 to 1994 and 1999 to 2002. Declines in dental caries were seen in both crowns and roots, and an overall decline in dental caries was seen in the U.S. population irrespective of age, gender, ethnicity, poverty status, education level, or smoking status. While the overall decline is a positive trend, it has been estimated that 68 percent of people experience caries before the age of 20, and by the age of 59 approximately 95 percent have experienced some decay.\(^5\) Despite the decrease in caries prevalence and severity in the permanent dentition and the increase in the proportion of children and adolescents who benefit from dental sealants, disparities remain. Ethnic minorities and those with lower income or lower education level, and current smokers across all age groups have larger unmet needs compared with their counterparts. There are currently around 36 million baby boomers, and this number is anticipated to increase over the next four decades to reach around 80 million baby boomers by 2050.\(^6\) Concomitantly, more people are keeping all of their natural teeth or retaining more teeth. As the U.S. population ages, preventive interventions will be needed for these age groups at the individual, clinical, and community level to help prevent coronal, root, and recurring caries.

Gingivitis
Gingivitis is first found in early childhood and increases in both prevalence and severity in adolescence before leveling off in older age groups.\(^7\) In the United States, the prevalence of gingivitis among schoolchildren has been found in a number of surveys to range from 40 percent to 60 percent. In adults, 50 percent were found to have gingivitis around at least three or four teeth.\(^8\)

Periodontal Disease
Moderate periodontal disease is found in the majority of the adult population. However, it is only in a minority of people that this progresses to generalized periodontitis. Data from the National Center for Health Statistics and
the National Institute of Dental and Craniofacial Research indicates that only 5 to 15 percent of any population suffers from generalized periodontitis.9

Ideally, gingivitis and/or periodontal disease should be prevented through excellent oral hygiene. Factors related to the attainment of good oral hygiene include the individual oral anatomy, age, gender, socioeconomic status, motivation and dexterity.

While advancing age may cause a decrease in a patient’s dexterity and, consequently, difficulty in performing oral hygiene procedures, and while with increasing age there is a greater likelihood of systemic conditions that may influence the intraoral environment and of intraoral conditions having had more time to progress, in and of itself age is not considered a risk factor for periodontal disease. Tooth retention, good oral hygiene, and periodontal health are closely associated, regardless of age. With respect to gender, national surveys have consistently shown that oral hygiene is poorer in males than in females, measured in terms of either soft plaque deposits or calculus. A further indication of this in the absence of other influencing factors is the higher level of clinical attachment loss (CAL) found in males than females.10

Socioeconomic status (SES) can influence the level of oral hygiene and the presence of gingivitis in individuals. Generally, people who are better educated, wealthier and live in more desirable circumstances enjoy better systemic and oral health than people who are less educated and financially disadvantaged.11 While gingivitis is clearly correlated to SES, there is no clear-cut correlation between SES and the prevalence of periodontitis.12

Bacteria are the causal agents in the onset of gingivitis and periodontal disease, but the presence of bacteria does not determine periodontal disease progression. Factors influencing the development of inflammation and the progression of periodontal disease may include genetics, hormonal changes, stress, and systemic diseases such as diabetes.

A genetic role was first identified in periodontal disease in 1997.13 The proinflammatory cytokine IL-1 is a key regulator of the host response to microbial infection14 and is tied to the genetic makeup of the individual, but is unlikely to be the only gene involved.15 More research will be necessary before the genetic contribution to periodontitis can be determined.

In women, hormonal issues (puberty, pregnancy and birth control pills) may cause an exaggerated response to bacterial plaque, and can result in gingivitis and possibly periodontitis.

Stress has been studied from the perspective of the mind-body connection and disease and assessed in terms of adverse life events, clinical depression, and coping skills. High levels of stress seem to be associated with progressive periodontitis as well as a number of systemic diseases.16

Diabetes lowers resistance to infections and delays healing. Periodontal infections can affect glycemic control, which ultimately can be life threatening. Conversely, poorly controlled diabetics are at increased risk for periodontal infections. Diabetics respond abnormally to inflammation and infection, demonstrating differences in gingival crevicular fluid and vascular abnormalities. A thorough understanding of the relationship between diabetes, periodontal disease, and professional and personal dental care is imperative in the care of diabetic patients.17

Strong risk factors for periodontal disease include smoking and tobacco use. Smoking has been shown to increase the risk of both periodontitis and refractory periodontitis. It is estimated that 90 percent of refractory chronic periodontitis cases are smokers,18 and healing following mechanical treatment is slower in smokers than in nonsmokers. Smoking inhibits the growth and attachment of fibroblasts associated with healing in periodontal ligaments, and is associated with changes to the vascularization of the local area. This results in a slower reduction in the number of blood cells, including neutrophils, following periodontal therapy.19 It is this poor vascularization (rather than less or less severe gingivitis and periodontal disease) that results in lower bleeding upon probing levels found in smokers with deep pockets.20

Recent research also suggests that heavy drinking is a risk factor, and that excessive alcohol consumption is associated with poorer oral hygiene.

**Plaque and Pocket Formation**

Microbial plaque is the primary etiologic factor in the development of gingival and periodontal diseases.21 As bacterial plaque accumulates on the tooth surface adjacent to the gingival margin, an inflammatory response begins within two to four days. Initially the plaque is supragingival and consists mainly of gram-positive bacteria, especially A. actinomycetemcomitans and Streptococcal species.22,23 This changes after day three, when filamentous bacteria begin to be seen on the surface of the plaque and later penetrate it. Over the next seven to 14 days, bacterial plaque becomes thicker. The connective tissue becomes infiltrated with fluid, lymphocytes, neutrophils, and plasma cells. Collagen fibers begin to break down, epithelium proliferates, and epithelial extensions are formed. Clinically, slight gingival enlargement occurs and gingival pockets (“pseudopockets”) are formed. Gingivitis at this stage can be reversed if plaque is controlled and inflammation reduced. If undisturbed, the disease process continues and clinically marginal redness, bleeding upon probing, and spongy marginal gingiva are apparent. While not all gingivitis leads to periodontal disease, plaque removal while the gingivitis is reversible will prevent the development of destructive periodontal disease.

Bacteria from supragingival plaque enter the gingival sulcus as subgingival plaque develops. Mature subgingival plaque consists mainly of gram-negative anaerobes, and between the third and 12th week after supragingival plaque forms, the subgingival plaque is well-differentiated and organized.24
The bacteria in plaque release biological irritants. The host response includes the release of antibodies, lymphocytes, and white blood cells. As periodontitis develops in response to the bacterial invasion and inflammation, soft- and hard-tissue destruction occurs with the release of cytokines, prostaglandins, and MMPs (associated with the destruction of hard tissue, or alveolar bone).

Pockets can be divided into gingival and true periodontal pockets, depending upon the degree of anatomic involvement (Table 1).

**Anatomy**

A healthy sulcus should measure from 0.5mm to 1.8mm in depth and should have no evidence of infection.25 The interdental gingiva is located between two adjacent teeth and may be flat or saddle-shaped (spaces between teeth), tapered or narrow (overlapping or crowded), pointed or pyramidal (anterior), or flat with two papillae (facial and lingual) connected by a col on posterior teeth. Most periodontal infections begin in the col area.26

While gram-negative organisms in the periodontal crevice are closely associated with periodontitis, an important finding is that supragingival plaque can serve as a natural reservoir for them.27

When the bacterial insult is strong enough to overwhelm the host defense, bacteria in supragingival plaque migrate subgingivally to form a subgingival biofilm.28 Since most periodontal infections begin in the col area, it is critical that all interdental plaque be removed.29 Toothbrushing alone has been proven to be ineffective at removing interdental plaque; it is necessary to use interdental cleaning aids. Frequent professional supragingival cleaning and good personal oral hygiene have been shown to have a beneficial effect on subgingival microbiota in moderately deep pockets. The benefits of scaling and root planing combined with personal plaque control in the treatment of chronic periodontitis have been clinically proven.30

**Devices Used for Removing Interdental Plaque**

Vibratory and sulcular toothbrushing techniques are useful for removing interdental plaque (Charter’s, Stillman and Bass methods), and are successful to some degree in removing bacterial plaque near the line angles of the facial and lingual embrasures.31 However, for complete plaque removal interdentally, other devices are needed (Table 2).

Interdental devices include the use of interdental brushes, tips, and floss. These have all been found to be effective, depending upon the targeted area of the interdental space.

Interdental brushes offer the advantage of being available in wider and new thinner versions, such as Go-Betweens® (Sunstar Butler), to accommodate the various dimensions of the interdental spaces. Patients who have dexterity issues often find interdental brushes easier to use. Effective at removing interdental plaque, brushes have the added advantage of serving as vehicles for the local application of antibacterial agents such as 0.12 percent chlorhexidine gluconate or desensitizing agents to exposed sensitive root areas. Interdental brushes are available with both coated and uncoated wire, and some include antibacterial agents (chlorhexidine) on the bristles.

<table>
<thead>
<tr>
<th>Table 1. Gingival and Periodontal Pockets</th>
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<tbody>
<tr>
<td><strong>Pockets</strong></td>
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<tr>
<td>Definition</td>
</tr>
<tr>
<td>Structures involved</td>
</tr>
<tr>
<td>Tooth wall</td>
</tr>
<tr>
<td>Base</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Broad gram-negative pathogens</td>
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<td>Clinical signs and symptoms</td>
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</table>

Adapted from Wilkins, Clinical Practice of the Dental Hygienist. 8th ed. p. 227.
Floss is able to reach into narrow interdental spaces where use of an interdental brush may be difficult and will also remove plaque at the interproximal contact. Preference, availability, interdental anatomy, and dexterity all play roles in the selection of an interdental device.

In addition to these interdental devices, there are a number of mechanical and chemotherapeutic adjuncts that may be useful in reducing and removing interdental plaque. Recent research on a novel electric interdental cleaning aid (Hummingbird™, Oral B) compared patients using either the cleaning aid with floss or manual floss interdentally over a period of 30 days. Manual floss was equally effective in reducing plaque and gingivitis, and, while safe and effective, the mechanical device offered no advantage.32

A study of another mechanical interdental device (Interclean) in a German population revealed significantly less plaque reduction than with manual interdental brushes. In this study, it was found that only 5 percent of interdental plaque remained following patient use of manual interdental brushes.33 In two other studies, the same device was compared to the use of dental floss, and the device and manual dental floss were found to be equally effective in reducing plaque.34,35

Based upon the results of these clinical studies, while there may be a subjective perception of improved interdental cleaning with mechanical devices, from a clinical perspective manual interdental brushes are superior and floss is equally effective in reducing and removing plaque interdentally.

Irrigators help remove plaque and debris interdentally and may also be used in conjunction with an antimicrobial agent. Irrigation can also be achieved through the use of blunt-ended cannulae to syringe antimicrobial agents into shallow to moderate periodontal pockets. The use of a chlorhexidine gluconate rinse has been shown to reduce plaque by 64.9 percent.36 Other adjuncts include the use of essential oil mouthrinses, zinc nitrate, CPC, and triclosan copolymer dentifrice.

<table>
<thead>
<tr>
<th>Mechanical Device</th>
<th>Indications for Use</th>
</tr>
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<tbody>
<tr>
<td>Interdental brushes</td>
<td>Proximal tooth surfaces adjacent to open embrasures, orthodontic appliances, fixed prostheses, dental implants, periodontal splints, space maintainers, concave proximal surfaces, exposed Class IV furcations; applications of fluorides for prevention of decay, particularly root surface caries and for surfaces adjacent to any prosthesis; antibacterial agents for control of plaque and gingivitis; desensitizing agents</td>
</tr>
<tr>
<td>Interdental tips</td>
<td>Plaque forming on tooth surface or just below gingival margin</td>
</tr>
<tr>
<td>Floss</td>
<td>Proximal surface of each tooth and line angles</td>
</tr>
<tr>
<td>Tufted dental floss</td>
<td>Wide embrasures; mesial and distal abutments of fixed partial dentures; under pontics; orthodontic appliance</td>
</tr>
<tr>
<td>Gauze strips</td>
<td>Proximal surfaces of widely spaced teeth; distal and mesial surfaces of abutment teeth; distal portions of dentures supported by implants</td>
</tr>
<tr>
<td>Toothpicks in holders</td>
<td>Plaque forming at or below gingival margin; interdental cleaning; concave proximal tooth surfaces; exposed furcation areas; orthodontic appliances</td>
</tr>
<tr>
<td>Wooden dental cleaners</td>
<td>Exposed proximal tooth surfaces</td>
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<tr>
<th>Adjuncts.</th>
<th>Indications for Use</th>
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<tr>
<td>Chemotherapeutic</td>
<td></td>
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<tr>
<td>Irrigation</td>
<td>Reduce gingivitis; reduce or alter microbial flora; penetration onto pocket; delivery of antimicrobial agents; periodontal maintenance</td>
</tr>
<tr>
<td>Mouthrinse</td>
<td>Preprocedural rinse, dental caries prevention; after nonsurgical periodontal therapy</td>
</tr>
<tr>
<td>Dentifrice</td>
<td>Control dental caries; remineralization; gingival health, calculus prevention; desensitization</td>
</tr>
</tbody>
</table>

Adapted from Wilkins, Clinical Practice of the Dental Hygienist. 8th ed. Ch. 24.
Conclusion
Clinical judgment, clinical skills, patient-related factors, and the patient’s current dental status affect oral health. Bacteria have a causal relationship in the etiology of caries and periodontal disease. Excellent oral hygiene is necessary to remove dental plaque to prevent oral disease, and clinical examination should include an assessment of plaque levels approximatively and interdentally as well as a review of diet, risk factors, and medical history.

While most patients brush for at least a short period of time, fewer use interdental devices in addition to toothbrushes. It has been shown that toothbrushes are relatively ineffective interdentally, and it is also known that periodontal disease typically begins interstitially. Adjunctive aids, including interdental brushes, floss, and mechanical devices, are available to remove interdental plaque. Clinical studies have shown that manual interdental brushes are particularly effective at reducing plaque and gingivitis. Selecting the sizes and types of interdental devices that are best for the patient in conjunction with him or her should include an assessment of the interdental space, contact points, retentive areas, gingival shape and position, and pockets. Patient demonstration can provide additional motivation and increase the likelihood of proper interdental cleaning.

Ultimately, the goal of patient care is to prevent, arrest, and control periodontal disease and caries. The patient’s ability to remove plaque from all areas, including interproximal areas, is an essential part of every patient’s self-care program.

References
10. Ibid.
11. Ibid.
12. Ibid.
18. Ibid.
19. Ibid.
20. Ibid.

Author Profile
Patty Bonasso Byrd, RDH, BS, is a graduate of the University of Louisville (1978) Dental Hygiene Program. She lectures nationwide on a variety of topics related to dental hygiene and is adjunct clinical faculty at UL and an author. She has been actively involved in the Kentucky State Dental Hygiene Association, serving as president (1998–99) and delegate to the ADHA.

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1. Ineffective or infrequent interdental cleaning may result in:
   a. Caries
   b. Gingivitis
   c. Periodontitis
   d. All of the above

2. National surveys have consistently shown that oral hygiene is:
   a. Poorer in females than males
   b. Poorer in males than females
   c. Equal in males and females
   d. Poorer in elderly males and females

3. Despite the decrease in caries prevalence and severity in the permanent dentition and the increase in proper prevention treatments, disparities remain.
   a. True
   b. False

4. Factors related to the attainment of good oral hygiene are:
   a. Oral anatomy
   b. Motivation
   c. Dexterity
   d. All of the above

5. Gingivitis is clearly correlated to SES and the prevalence of periodontitis.
   a. True
   b. False

6. Age is not considered a risk factor for periodontal disease.
   a. True
   b. False

7. Statement 1: Bacteria are the causal agents in the onset of gingivitis and periodontal disease.
   Statement 2: The presence of bacteria does not determine periodontal disease progression.
   a. Statement #1 is true. Statement #2 is true.
   b. Statement #1 is true. Statement #2 is false.
   c. Statement #1 is false. Statement #2 is true.
   d. Statement #1 is false. Statement #2 is false.

8. ______ seem(s) to be associated with progressive periodontitis as well as a number of systemic diseases.
   a. Hormonal status
   b. Gender
   c. Stress
   d. Socioeconomic status

9. Risk factors for periodontal disease include:
   a. Smoking and tobacco use
   b. Diabetes
   c. Poor oral hygiene
   d. All of the above

10. Poor vascularity results in lower bleeding upon probing levels found in smokers with deep pockets.
    a. True
    b. False

11. As bacterial plaque accumulates on the tooth surface adjacent to the gingival margin, an inflammatory response begins within:
    a. Twenty-four hours
    b. Two to four days
    c. Five to seven days
    d. Seven to fourteen days

12. The structures involved in a periodontal pocket include:
    a. Bone
    b. Cementum
    c. Periodontal ligament
    d. All of the above

13. Bacteria from supragingival plaque can enter the sulcus and be a source for subgingival plaque development.
    a. True
    b. False

14. As periodontitis develops in response to bacterial invasion and inflammation, soft- and hard-tissue destruction occurs with the release of:
    a. MMPs
    b. Prostaglandins
    c. Cytokines
    d. All of the above

15. Depending upon the degree of anatomic involvement, pockets can be divided into:
    a. Gingival and subgingival
    b. Gingival and true periodontal
    c. Periodontal and microbial
    d. Gram-negative and pseudopockets

16. The interdental gingiva is located between two adjacent teeth and may be:
    a. Pointed or pyramidal
    b. Flat or saddle-shaped
    c. Tapered or narrow
    d. All of the above

17. When the bacterial insult is strong enough to overwhelm the host defense, bacteria in the supragingival plaque will:
    a. Stay in the supragingival plaque
    b. Migrate subgingivally to form a subgingival biofilm
    c. Die within a couple of days
    d. Not cause inflammation

18. It is critical that all interdental plaque is removed, since most periodontal infections begin in:
    a. The col
    b. The pseudopocket
    c. The gingival pocket
    d. The base

19. Devices used to remove plaque interdentally include:
    a. Wooden dental cleaners
    b. Tufted dental floss
    c. Interdental brushes
    d. All of the above

20. What toothbrushing techniques are useful for removing interdental plaque?
    a. Stillman and Bass methods
    b. Vibratory
    c. Scular
    d. All of the above

21. What type of device offers the advantage of being available in wider and new thinner versions?
    a. Floss
    b. Interdental brushes
    c. Toothpicks
    d. Tips

22. Which of the following plays a role in the selection of an interdental device?
    a. Preference
    b. Availability
    c. Dexterity
    d. All of the above

23. In addition to floss and interdental brushes, there are a number of mechanical adjuncts that may be useful in reducing interdental plaque.
    a. True
    b. False

24. The indications for use of dentifrice include:
    a. Reduction of gingivitis
    b. Delivery of antimicrobial agents
    c. Calculus prevention
    d. All of the above

25. Irrigation can be achieved through the use of:
    a. A syringe with blunt-ended cannula
    b. A syringe with cartridge
    c. Essential oil mouthrinses
    d. Diet

26. The use of a chlorhexidine gluconate rinse has been shown to reduce plaque by:
    a. 46.9 percent
    b. 64.9 percent
    c. 94.6 percent
    d. A factor of 10

27. While most patients brush for at least a short period of time:
    a. They use interdental devices as much as toothbrushes
    b. They also use interdental devices more than toothbrushes
    c. Fewer use interdental devices in addition to toothbrushes
    d. Fewer use adjunctive chemotherapeutics with interdental devices in addition to toothbrushes

28. It has been shown that toothbrushes are relatively ineffective interdentally.
    a. True
    b. False

29. Ultimately, the goal of patient care is to:
    a. Arrest periodontal disease and caries
    b. Control periodontal disease and caries
    c. Prevent periodontal disease and caries
    d. All of the above

30. The patient’s ability to remove plaque effectively and thoroughly is not essential to every patient’s self-care program.
    a. True
    b. False

Questions
Interdental Cleaning

Educational Objectives

1. Discuss the current status of caries, gingivitis, and periodontal disease in the United States
2. List the dental implications associated with inadequate/ineffective interdental plaque control
3. Recognize the clinical signs of ineffective interdental plaque control and identify patients who are at a high risk for periodontal diseases
4. Recommend appropriate interdental cleaning methods and devices for specific patient needs, and explain the necessity of interdental plaque control as part of the patient's complete self-care program

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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 #3: 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. Was the course content inappropriate, confusing, or contradictory? 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.
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