Oral side effects are commonplace with cancer chemo and adjunctive therapies. Intravenous bisphosphonate therapy can lead to osteonecrosis, especially after a tooth extraction or oral surgery. Scheduled cleanings should be performed every six months or quarterly, as well as compliance with meticulous home oral hygiene, depending on risk factors and the patient’s overall health. Chemotherapy can cause a host of oral side effects including hypersensitivity due to discomfort and pain, ulcerated gingival tissues, impaired taste buds, erosion of tooth enamel due to vomiting, and mucositis. The primary method of treating mucositis is palliative therapy. Therapy includes home oral hygiene, pain control, oral mouth rinses, and palliation of dry mouth. It is important for dental hygienists to be aware of these side effects and how to counsel their patients appropriately.

Abstract
Oral side effects are commonplace with cancer chemo and adjunctive therapies. Intravenous bisphosphonate therapy can lead to osteonecrosis, especially after a tooth extraction or oral surgery. Scheduled cleanings should be performed every six months or quarterly, as well as compliance with meticulous home oral hygiene, depending on risk factors and the patient’s overall health. Chemotherapy can cause a host of oral side effects including hypersensitivity due to discomfort and pain, ulcerated gingival tissues, impaired taste buds, erosion of tooth enamel due to vomiting, and mucositis. The primary method of treating mucositis is palliative therapy. Therapy includes home oral hygiene, pain control, oral mouth rinses, and palliation of dry mouth. It is important for dental hygienists to be aware of these side effects and how to counsel their patients appropriately.

Educational Objectives
1. List the signs and symptoms of osteonecrosis associated with bisphosphonate therapy.
2. Describe the oral health care that patients receiving bisphosphonates should perform in order to minimize the risk of developing osteonecrosis.
3. Describe the potential consequences of tooth extraction in a patient receiving bisphosphonate therapy.
4. List and describe the treatments available for oral mucositis.
5. List and describe the guidelines that the dental hygienist should use when performing oral health care on patients receiving chemotherapy.
6. List and describe the guidelines that the patient receiving chemotherapy should follow to maintain good oral health care.

Author Profile
Laurel Swartzentruber is a 2013 Bachelor of Science Degree Candidate in the Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University, Norfolk, Virginia. This paper was the result of Ms. Swartzentruber’s research project for the University’s Honors Program. She plans on practicing dental hygiene in the Virginia Beach area.

Dr. Elena Bablenis Haveles, Bs Pharmacy, PharmD is an Adjunct Associate Professor of Pharmacology in the Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University, Norfolk, Virginia. Dr. Haveles has taught at Old Dominion University for almost 20 years. Please direct all correspondence to Dr. Haveles. She can be contacted at ehaveles@odu.edu

Author Disclosure
Laurel Swartzentruber and Dr. Elena Bablenis Haveles have no potential conflicts of interest to disclose.
Abstract
Oral side effects are commonplace with cancer chemo and adjunctive therapies. Intravenous bisphosphonate therapy can lead to osteonecrosis, especially after a tooth extraction or oral surgery. Scheduled cleansings should be performed every six months or quarterly, as well as compliance with meticulous home oral hygiene, depending on risk factors and the patient’s health. Chemotherapy can cause a host of oral side effects including hypersensitivity due to discomfort and pain, ulcerated gingival tissues, impaired taste buds, erosion of tooth enamel due to vomiting, and mucositis. The primary method of treating mucositis is palliative therapy. Therapy includes home oral hygiene, pain control, oral mouth rinses, and palliation of dry mouth. It is important for dental hygienists to be aware of these side effects and how to counsel their patients appropriately.

Educational Objectives
1. List the signs and symptoms of osteonecrosis associated with bisphosphonate therapy.
2. Describe the oral health care that patients receiving bisphosphonates should perform in order to minimize the risk of developing osteonecrosis.
3. Describe the potential consequences of tooth extraction in a patient receiving IV bisphosphonate therapy.
4. List and describe the treatments available for oral mucositis.
5. List and describe the guidelines that the dental hygienist should use when performing oral health care on patients receiving chemotherapy.
6. List and describe the guidelines that the patient receiving chemotherapy should follow to maintain good oral health care.

Introduction
Cancer is a devastating fact in society today. It is the second leading cause of death in the United States, surpassed only by heart disease. According to the American Cancer Society, as of January 1, 2008, it was estimated that there were 11,958,000 people in the United States alone who were living with some type of invasive cancer. Because so many people are being treated for cancer, the dental hygienist should be knowledgeable of the many drugs used to treat cancer and their side effects that affect oral health care.

While there is no known cure for cancer, there are a number of medications and treatments that kill cancer cells resulting in a cancer-free state. Unfortunately, these treatments are not without side effects (Table 1). Oral health care providers are at the forefront of providing the patient with the necessary tools for treating and educating the patient about the oral implications of these drugs. In many cases, it may be possible for the oral health care provider to help lessen these side effects through the way treatment is rendered.

<table>
<thead>
<tr>
<th>Common Cancer Drugs</th>
<th>Gastrointestinal Side Effects</th>
<th>Bone Marrow Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclophosphamide</td>
<td>Nausea, vomiting, abdominal pain, diarrhea, loss of appetite</td>
<td>Bone marrow suppression</td>
</tr>
<tr>
<td>Doxorubicin</td>
<td>Nausea, vomiting, ulceration of the colon, anorexia, abdominal pain, diarrhea, dehydration</td>
<td>Decreased function of bone marrow, low blood counts</td>
</tr>
<tr>
<td>Anastrozole</td>
<td>Nausea, vomiting, diarrhea, abdominal pain, anorexia, constipation</td>
<td>Leukopenia</td>
</tr>
<tr>
<td>Exemestane</td>
<td>Nausea, vomiting, abdominal pain, dyspepsia (indigestion), diarrhea, anorexia, constipation, increase in appetite</td>
<td>Lymphocytopenia (abnormally low lymphocyte levels)</td>
</tr>
<tr>
<td>Letrozole</td>
<td>Nausea, vomiting, constipation, anorexia, abdominal pain, dyspepsia, diarrhea</td>
<td>None reported</td>
</tr>
<tr>
<td>Trastuzumab</td>
<td>Nausea, vomiting, diarrhea, anorexia</td>
<td>Neutropenia</td>
</tr>
<tr>
<td>Paclitaxel</td>
<td>Nausea, vomiting, diarrhea, mucositis</td>
<td>Bone marrow suppression</td>
</tr>
</tbody>
</table>

Bisphosphonates
Bisphosphonates are frequently used in patients undergoing chemotherapy to increase bone density and reduce the risk for developing fractures. Their benefit has been well established in the treatment of hypercalcemia of malignancy and the prevention of skeletal complications from bone metastasis.

Unfortunately, when given intravenously (IV), they can lead to osteonecrosis of the jaw, which is an area of exposed bone in either the maxilla or mandible that does not heal.

Clinical Presentation and Diagnosis of Osteonecrosis
Osteonecrosis can remain asymptomatic for weeks or even months and is usually identified by its unique clinical presentation of exposed bone in the oral cavity. The lesions normally become symptomatic when the site becomes secondarily infected, or there is trauma to the adjacent or healthy tissue from the irregular surfaces of the exposed bone. Once symptomatic, the signs and symptoms of osteonecrosis include localized pain, soft tissue swelling and inflammation, loosening of previously stable teeth, drainage, and exposed bone. Normally, these symptoms occur at the site of previous tooth extractions or other dental surgical procedures. However, they can occur spontaneously.

It should be noted that some patients may present with atypical symptoms to include “numbness,” the feeling of a “heavy jaw,” and various dysesthesias. Objective signs that may occur...
before clinical oral symptoms include a sudden change in the health of periodontal or mucosal tissue, failure of the oral mucosa to heal, undiagnosed oral pain, loose teeth, and soft tissue infection.\footnote{2}

If osteonecrosis does develop, it can lead to a host of other oral side effects. The gingiva may have poor healing time and may become infected and exudative. In addition, the jaw may develop numbness, pain, or swelling.\footnote{8} Any patient who is receiving IV bisphosphonates should have their oral cavity examined thoroughly for osteonecrosis. They should also practice very meticulous oral hygiene, and should keep regularly scheduled dental cleanings in order to help reduce the risk for developing this condition. The frequency of scheduled cleanings is normally every six months but, in this instance, may be scheduled every three to four months depending on the number of risk factors and the patient’s overall oral health. Also, removable dentures should be examined for the potential to cause tissue injury and be adjusted accordingly.\footnote{9} In instances where osteonecrosis does develop, a removable appliance, such as a thin mouthguard, can sometimes be used to protect the areas of exposed bone.\footnote{9}

Patients who are receiving IV bisphosphonates have a high risk of developing osteonecrosis after oral surgery or tooth extraction.\footnote{10} The dental hygienist needs to be very careful not to damage any soft tissue. Also, the patient should check with an oral surgeon and medical oncologist to see if it would be possible to discontinue IV bisphosphonates prior to oral surgery. This would give the patient the best chance of not developing osteonecrosis.\footnote{10} The patient could then resume the IV bisphosphonates once the surgical site is completely healed. As another precautionary measure, the oral surgeon could recommend that the patient start a course of antibiotics before the surgery to fight off any possible infections.\footnote{10} These antibiotics should also continue after the surgery for at least 10 days.\footnote{9} Research has shown that penicillin generally stands the best chance at fighting off infections in these patients.\footnote{9} The most important thing to remember is to always check with the physician or oncologist before performing any dental treatment or stopping any medications.

## Oral Side Effects

Chemotherapeutic medications are the treatment of choice for cancer therapy (Table 1). There are many different types of chemotherapeutic drugs, so it is always wise to look up the specific one that the patient is taking in order to look out for any unique side effects. Oral side effects occur often with chemotherapy, and they include hypersensitivity due to discomfort and pain, ulcerated gingival tissues, and impaired taste buds (Table 2).\footnote{1} Additionally, chemotherapy can cause vomiting, which leads to tooth enamel erosion. The erosion can lead to tooth sensitivity. These patients should be advised not to brush their teeth immediately after vomiting because brushing removes the outer layers of enamel which has been softened by the acidic discharge. Instead, the oral health care provider can suggest that these patients rinse the mouth out very well with lukewarm water, with either baking soda or salt, and then brush afterwards. Lastly, these medications can cause xerostomia, which can lead to caries. Health care providers should educate patients on salivary substitutes and should suggest that these patients begin a home fluoride regimen.\footnote{3}

### Table 2. Oral Side Effects of Common Cancer Chemotherapeutic Agents\footnote{22, 23}

<table>
<thead>
<tr>
<th>Common Cancer Drugs</th>
<th>Oral Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclophosphamide</td>
<td>Ulceration of the oral mucosa</td>
</tr>
<tr>
<td>Doxorubicin</td>
<td>Hyperpigmentation of the oral mucosa, especially the tongue, mucositis</td>
</tr>
<tr>
<td>Anastrozole</td>
<td>Dry mouth</td>
</tr>
<tr>
<td>Exemestane</td>
<td>None reported</td>
</tr>
<tr>
<td>Letrozole</td>
<td>Dry mouth, oral taste changes, metallic taste</td>
</tr>
<tr>
<td>Trastuzumab</td>
<td>Mouth sores</td>
</tr>
<tr>
<td>Paclitaxel</td>
<td>Mouth sores</td>
</tr>
</tbody>
</table>

### Mucositis

One of the most common oral side effects of chemotherapeutic agents is mucositis, which is the ulceration of the mucosa lining the digestive tract, including the oral cavity.\footnote{11} Mucositis is a common cause of morbidity in patients undergoing cancer chemotherapy. According to the National Cancer Institute (NCI), the incidence of NCI Grade 3–4 oral and gastrointestinal (GI) mucositis is estimated between 5% and 15%.\footnote{12} Also, oral and gastrointestinal mucositis can occur in up to 100% of patients undergoing high-dose chemotherapy with hematopoietic stem cell transplantation (HSCT).\footnote{13} From the patient’s perspective, it is the HSCT’s most debilitating side effect.\footnote{14}

Oral mucositis is all encompassing and can range from mild inflammation and redness of the mucosa to severe ulceration. Symptoms vary and include pain and discomfort to the complete inability to tolerate food or drink. Mucositis may be so severe that the patient may not be able to tolerate additional chemotherapy or radiation therapy. In this case, treatment may be delayed, which could limit the effectiveness of chemotherapy or radiation therapy. Also, patients with inflamed mucosa and reduced immunity due to chemotherapy and radiation therapy are at high risk for opportunistic infections. Not only is the mucositis painful, but it also increases the risk of developing infections and can sometimes even lead to death. Furthermore, the patient will generally need to prolong a hospital stay or delay additional chemotherapy in order to manage this additional complication. Lastly, mucositis can adversely affect the patient’s gums and teeth.\footnote{15}

Many different treatment options are available to treat oral mucositis. To date, the primary method of treating mucositis is palliative therapy. This includes general oral care protocols, pain control, oral mouth rinses, interventions to reduce the mucositis associated with chemotherapy, and the palliation of dry mouth.\footnote{16}
The primary symptom of mucositis is pain, which can adversely affect nutritional intake, oral health care, and quality of life. Though they do not provide long-term relief, saline mouth rinses, ice chips, and topical, alcohol-free mouth rinses with an anesthetic provide short-term relief. More often than not, 2% viscous lidocaine is used. Lidocaine is often mixed with equal parts of diphenhydramine and a soothing agent such as Maalox® or Kaopectate®. Other topical mucosal bioadherent agents have been studied and include sucralfate chlorhexidine and benzoylamine topical rinse. However, updated clinical practice guidelines for treating mucositis do not recommend their use because their effectiveness has not been established. The current literature on nonopioid pain control includes the use of a number of adjuvant treatments, including nonsteroidal anti-inflammatory drugs and gabapentin. Cryotherapy or ice chips appear to be effective in treating mucositis pain. Current clinical practice guidelines provide a Level I, Grade A recommendation for patient-controlled analgesia (PCA) with morphine for those patients undergoing HSCT.

Patients receiving chemotherapy are at high risk for developing mucositis so it is important that they maintain meticulous oral hygiene. Unfortunately, there is not yet a definite cure for mucositis, so symptomatic treatment is the only option available to cancer patients. This symptomatic treatment includes maintaining a very clean oral cavity through regular brushing, and also avoiding any strong stimuli, such as spices, foods that are too hot, and smoking. If the mouth is uncomfortable, the patient can use a solution of a ½ teaspoonful of baking soda and/or a ¼ teaspoonful of salt in 1 cup of warm water several times a day to alleviate dry mouth symptoms. This will also clean and lubricate the oral tissue and provide a protective barrier for the oral mucosa. Chew tart, sugarless gum to enhance salivary flow and use cholinergic agents (saliva substitutes) as necessary.

### Guidelines for the Dental Hygienist
As health care providers, there are certain things that we need to know about treating cancer patients. Chemotherapy treatments are incredibly exhausting for the patient, so the best time to administer dental hygiene care is right before the next treatment. When care is administered right before the next chemotherapy appointment, patients won’t be too weak to handle the dental treatment and white blood cells should be at their highest levels. Before any dental care is rendered, both the patient and the hygienist should consult the oncologist in order to find out the blood counts for the patient. Platelet counts need to be greater than 75,000 mm³ so that the blood can clot properly, and the neutrophil count should be greater than 1,000 mm³. Treatment should be given whenever the patient has the highest possible level of formed blood elements. When the white blood cell count is too low, there is an increased risk for infection, and so it is very important to make sure that the blood counts are as high as possible.

During the actual appointment, the dental hygienist can have the patient rinse with chlorhexidine mouth rinse to help avoid any infections. When performing the intraoral exam, the dental hygienist should check for any lesions that could be cultured in order to test for infection. Since chemotherapy inhibits the salivary flow, some patients will probably have more biofilm and caries than usual. The dental professional should educate the patient on how to avoid caries and practice proper oral hygiene. Subsequent dental appointments for patients who experience

### Table 3. Oral Care Guidelines for Patients

<table>
<thead>
<tr>
<th>Brushing</th>
<th>Mouth Rinses</th>
<th>Flossing</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use an ultra soft toothbrush, and rinse it with warm water before brushing to avoid damaging any tissues.</td>
<td>Rinsing with a solution of baking soda and saline will help tender tissues to heal.</td>
<td>Floss at least once daily!</td>
<td>Do not wear ill-fitting dentures. These can increase the risk of a disease process called osteonecrosis of the jaw.</td>
</tr>
<tr>
<td>Replace your toothbrush either every 3 months OR after any infection.</td>
<td>NEVER use a mouthwash that contains alcohol! It will burn the tissues.</td>
<td>If the gums are bleeding heavily, do not floss those areas. Wait for the tissues to heal.</td>
<td>Be aware of the side effects of any medications you are taking! Knowing what to expect can help you to maintain healthy teeth and gums.</td>
</tr>
<tr>
<td>Use mild toothpaste. Avoid using strong flavors or whitening agents.</td>
<td>Many chemotherapeutic agents cause dry mouth, which may lead to cavities. Topical fluoride treatments can help to prevent this.</td>
<td></td>
<td>Please consult your dental professionals with any specific questions and concerns!</td>
</tr>
<tr>
<td>Use a chlorhexidine mouth rinse to help prevent infections. Ask your dental professional for more information.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
more biofilm than normal should be scheduled for less than six months. Typically, scheduling an appointment every four months will suffice.

Oral Care Guidelines for the Patient

There are certain oral health care guidelines that dental hygienists need to introduce to cancer patients (Table 3). Most importantly, the hygienist should emphasize that the patient needs to maintain very good oral hygiene. Patients should be encouraged to brush their teeth and gums after each meal and at bedtime. When brushing, the patient should use an ultra soft toothbrush and rinse it under warm water. This helps to avoid damaging any of the tissues. The toothbrush should be changed often, typically every three months or after any type of infection. Only mild toothpastes should be used, and these patients should avoid using any strong flavors or whitening toothpastes, as these can irritate the gingiva. The patient should swab their teeth and gums with a gentle cloth if they cannot tolerate even a mild toothbrush.

The dental hygienist should also encourage the patient to floss at least once daily, but the patient should never floss any areas that are bleeding heavily. Baking soda rinses are sometimes soothing to the oral mucosa and may be palliative.

Topical fluoride can be used to prevent the caries that are caused by the inhibited salivary flow. The hygienist should make sure to tell the patient never to use a mouthwash that contains alcohol. This will cause a strong burning sensation. Patients should be encouraged to report any redness, tenderness or sores on their lips or mouth and to seek prompt treatment for oral mucositis or infection.

Also, if the patient wears dentures, the hygienist should make sure that they fit properly. Ill-fitting dentures greatly increase the risk of developing osteonecrosis of the jaw. The dentures should be removed and cleaned every night, and the patient should not wear their dentures while they are sleeping.

Conclusion

When people find out that they will be going through chemotherapy for cancer treatment, they usually think of side effects such as losing their hair, vomiting, or fatigue. They are much less likely to think of the side effects that will take place in their mouths, although these oral implications can be just as bad as the other side effects. As dental professionals, it is our responsibility to supply these patients with the necessary knowledge and tools to deal with these oral side effects. In order to accomplish this task, we need to be knowledgeable on the subject, and this will help us to provide the best care possible to each and every one of our patients.

References

Author Profile
Laurel Swartzentruber is a 2013 Bachelor of Science Degree Candidate in the Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University, Norfolk, Virginia. This paper was the result of Ms. Swartzentruber’s research project for the University’s Honors Program. She plans on practicing dental hygiene in the Virginia Beach area.

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Questions

1. All of the following are oral care guidelines for patients undergoing chemotherapy except one. Which of the following is the exception?
   a. Only use mild toothpastes.
   b. Don’t floss areas that are bleeding heavily.
   c. Only use medium toothbrushes.
   d. Use a chlorhexidine rinse to help prevent infections.

2. Which of the following is an oral side effect of bisphosphonates?
   a. Osteonecrosis of the jaw
   b. Gingival hyperkeratosis
   c. Gingival hyperplasia
   d. Migratory glossitis

3. All of the following are symptomatic treatments for mucositis except one. Which of the following is the exception?
   a. Avoid spicy foods.
   b. Keep the lips well moisturized.
   c. Use analgesics or topical anesthetics.
   d. Rinse with an alcohol mouthwash.

4. Before dental care can be rendered for a cancer patient, platelet counts should be above __________ mm$^3$.
   a. 25,000
   b. 50,000
   c. 75,000
   d. 100,000

5. All of the following are common oral findings in patients undergoing chemotherapy except one. Which of the following is the exception?
   a. Xerostomia
   b. Actinic cheilitis
   c. Excess biofilm
   d. Mouth ulcers

6. The frequency of maintenance oral health cleanings for patients with risk factors and overall poor health that are receiving bisphosphonates is:
   a. Every 6 months
   b. Every 3-4 months
   c. Monthly
   d. Every 2 months

7. All of the following are risk factors for developing osteonecrosis except one. Which one is the exception?
   a. tooth extractions
   b. oral surgery
   c. ill-fitting dentures
   d. xerostomia

8. Chemotherapy can cause nausea and vomiting, which can lead to the erosion of tooth enamel. The dental hygienist should instruct the patient to perform which of the following oral health care measures after vomiting:
   a. Rinse with a alcohol-free mouth rinse
   b. Brush with a soft-bristle toothbrush and a mild toothpaste
c. Rinse with lukewarm water
d. Rinse with hot water

9. All of the following provide short-term symptomatic relief for the treatment of the pain associated with mucositis except one. Which one is the exception?
   a. alcohol-containing mouth rinses
   b. ice chips
c. 2% viscous lidocaine
d. saline mouth rinses

10. Patients undergoing chemotherapy should be encouraged to change their toothbrushes:
    a. every 6 months
    b. only after an infection
c. every 3-4 months or after any infection
d. every 6 months or after any infection

11. According to the American Cancer Society, approximately how many people are living with invasive cancer?
    a. 5,000,000
    b. 10,000,000
c. 12,000,000
d. 3,000,000

12. Which of the following classes of drugs is associated with osteonecrosis of the jaw?
    a. Aromatase inhibitors
    b. Bisphosphonates
c. Vinca alkaloids
d. Taxanes

13. All of the following are typical signs and symptoms of osteonecrosis except one. Which of the following is the EXCEPTION?
    a. Localized pain
    b. Soft tissue swelling
c. Exposed bone
d. Feeling of a “heavy jaw”

14. Once osteonecrosis develops, it can lead to other oral side effects. Which of the following is one of those side effects?
    a. Poor healing time
    b. Mouth sores
    c. Dry mouth
d. Metallic taste

15. Which of the following can be used to protect areas of exposed bone as a result of bisphosphonate therapy?
    a. Oral antibiotics
    b. A thin mouthguard or removable appliance
c. Topical antibiotics
d. A permanent appliance

16. According to current research, which of the following is the drug of choice for avoiding infections in patients with osteonecrosis as a result of bisphosphonate therapy?
    a. Metronidazole
    b. Clarithromycin
c. Tetracycline
d. Penicillin

17. Patients that experience xerostomia as a result of chemotherapy drugs are at higher risk for developing caries. The dental hygienist should recommend which of the following to help reduce that risk?
    a. Use of a fluoride regime
    b. Use of alcohol-free mouth rinses
c. Use of standard alcohol rinses
d. Use of sour candies

18. According to the National Cancer Institute, the incidence of Grade 3-4 oral and gastrointestinal mucositis is estimated at:
    a. 15%-20%
    b. 5%-10%
c. 5%-15%
d. 1%-5%

19. The incidence of oral and gastrointestinal mucositis in patients undergoing high-dose chemotherapy with hematopoietic stem cell transplantation is:
    a. 50%
    b. 100%
c. 90%
d. 75%

20. The primary method of treating mucositis is palliative therapy. All of the following are considered to be palliative EXCEPT one. Which of the following is the EXCEPTION?
    a. Pain control
    b. Oral mouth rinses
c. Intravenous pain medication
d. Palliative treatment of dry mouth

21. Though they do not provide long-term relief all of the following except one provide short-term relief for the pain associated with mucositis.
    a. Ice chips
    b. Saline mouth rinses
c. 2% viscous lidocaine with a topical, alcohol-free mouth rinse
d. 4% viscous lidocaine with a topical, alcohol-free mouth rinse

22. 2% Viscous lidocaine is an effective means of controlling mucositis pain. It is often mixed with all of the following exceptions. Which one is the EXCEPTION?
    a. Sucralfate
    b. Diphenhydramine
c. Maalox®
d. Kapectate®

23. Which of the following is recommended for patients undergoing hematopoietic stem cell transplantation that experience mucositis?
    a. Ibuprofen
    b. Codeine
c. Morphine
d. Hydrocortone

24. All of the following are effective in treating mucositis pain except for one. Which of the following is the EXCEPTION?
    a. Cytoreduction
    b. NSAIDs
    c. Benzoyl peroxide rinse
d. Gabapentin

25. The Hyposalivation associated with chemotherapy can aggravate existing mucositis. Patients can be advised to rinse with which of the following solutions?
    a. ½ teaspoonful of baking soda and/or ¼ teaspoonful of salt in 1 cups lukewarm water several times a day.
    b. ½ teaspoonful of baking soda and/or ¼ teaspoonful of salt in 2 cups lukewarm water several times a day.
    c. ½ teaspoonful of baking soda and/or ¼ teaspoonful of salt in 1 cups lukewarm water several times a day.
    d. ½ teaspoonful of baking soda and/or ¼ teaspoonful of salt in 1 cups lukewarm water several times a day.

26. All of the following can be used to treat the dry mouth associated with chemotherapy except for one. Which of the following is the EXCEPTION?
    a. Sip water
    b. Chew tart, sugarless gum or candy
c. Use of anticholinergic drugs
d. Artificial saliva substitutes

27. Cancer chemotherapeutic agents can cause many different oral side effects. Which of the following drugs can cause mouth sores?
    a. Exemestane
    b. Trastuzumab
    c. Doxorubicin
d. Anastrozole

28. Which of the following cancer chemotherapeutic agents can cause oral taste changes?
    a. Anastrozole
    b. Paclitaxel
c. Letrozole
d. Cyclophosphamide

29. Cancer chemotherapeutic drugs are known to adversely affect the bone marrow. Which of the following is an EXCEPTION to this statement?
    a. Paclitaxel
    b. Doxorubicin
c. Cyclophosphamide
d. Letrozole

30. Which of the following cancer chemotherapeutic agents can cause Hyperpigmentation of the oral mucosa?
    a. Doxorubicin
    b. Cyclophosphamide
c. Exemestane
d. Letrozole
**Educational Objectives**

1. List the signs and symptoms of osteonecrosis associated with bisphosphonate therapy.
2. Describe oral health care and the patient receiving bisphosphonate should perform to avoid complications of developing osteonecrosis.
3. Describe the potential consequences of tooth extraction in a patient receiving bisphosphonate therapy.
4. List and describe the treatments available for oral mucositis.
5. List and describe the guidelines that dentists should follow when performing oral health care on patients receiving chemotherapy.
6. List and describe the guidelines that the patient receiving chemotherapy should follow to maintain good oral health care.

**Course Evaluation**

1. Were the individual course objectives met?  **Objective #1:** Yes  No
2. To what extent were the course objectives accomplished overall?  **Objective #2:** 4.3 3210
3. Please rate your personal mastery of the course objectives.  **Objective #3:** 4.3 3210
4. How would you rate the objectives and educational methods?  **Objective #4:** 4.3 3210
5. How do you rate the author’s grasp of the topic?  **Objective #5:** 4.3 3210
6. Please rate the instructor’s effectiveness.  **Objective #6:** 4.3 3210
7. Was the overall administration of the course effective?  **Objective #7:** 4.3 3210
8. Please rate the usefulness and clinical applicability of this course.  **Objective #8:** 4.3 3210
9. Please rate the usefulness of the supplemental webliography.  **Objective #9:** 4.3 3210
10. Do you feel that the references were adequate?  **Objective #10:** Yes  No
11. Would you participate in a similar program on a different topic?  **Objective #11:** Yes  No
12. If any of the continuing education questions were unclear or ambiguous, please list them.
13. Was there any subject matter you found confusing? Please describe.
14. How long did it take you to complete this course?
15. What additional continuing dental education topics would you like to see?

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**COURSE EVALUATION and PARTICIPANT FEEDBACK**

**ANSWER SHEET**

**Oral Health Care during Chemotherapy**

Name:  
Title:  
Specialty:  
Address:  
E-mail:  
City:  
State:  
ZIP:  
Country:  
Telephone: Home (  )  
Office (  )  
Lic. Renewal Date:  

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 2 CE credits. 6) Complete the Course Evaluation below. 7) Make check payable to PennWell Corp.  

For questions Call 216.398.7822

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**Educational Objectives**

1. List the signs and symptoms of osteonecrosis associated with bisphosphonate therapy.
2. Describe oral health care and the patient receiving bisphosphonate should perform to avoid complications of developing osteonecrosis.
3. Describe the potential consequences of tooth extraction in a patient receiving bisphosphonate therapy.
4. List and describe the treatments available for oral mucositis.
5. List and describe the guidelines that dentists should follow when performing oral health care on patients receiving chemotherapy.
6. List and describe the guidelines that the patient receiving chemotherapy should follow to maintain good oral health care.

**Course Evaluation**

1. Were the individual course objectives met?  **Objective #1:** Yes  No
2. To what extent were the course objectives accomplished overall?  **Objective #2:** 4.3 3210
3. Please rate your personal mastery of the course objectives.  **Objective #3:** 4.3 3210
4. How would you rate the objectives and educational methods?  **Objective #4:** 4.3 3210
5. How do you rate the author’s grasp of the topic?  **Objective #5:** 4.3 3210
6. Please rate the instructor’s effectiveness.  **Objective #6:** 4.3 3210
7. Was the overall administration of the course effective?  **Objective #7:** 4.3 3210
8. Please rate the usefulness and clinical applicability of this course.  **Objective #8:** 4.3 3210
9. Please rate the usefulness of the supplemental webliography.  **Objective #9:** 4.3 3210
10. Do you feel that the references were adequate?  **Objective #10:** Yes  No
11. Would you participate in a similar program on a different topic?  **Objective #11:** Yes  No
12. If any of the continuing education questions were unclear or ambiguous, please list them.
13. Was there any subject matter you found confusing? Please describe.
14. How long did it take you to complete this course?
15. What additional continuing dental education topics would you like to see?

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