The development of mucositis in patients being treated for cancer can have devastating effects. Mucositis can cause a cascade phenomenon that has the potential to interfere with almost every aspect of a patient’s life. As such, the impact of oral mucositis on a patient’s physical and psychological well-being and quality of life can be significant. The condition increases morbidity and mortality and also lead to increased healthcare costs (Elting et al., 2003; Silverman, 2007). Patients with mucositis may develop pain and difficulty in swallowing, eating, drinking, and even talking, which may then compromise their nutritional status, psychological well-being, and overall healing process (Silverman). When oral cavity breakdown occurs, the loss of mucosal integrity can put patients at risk for many additional problems, including anorexia, dry mouth, change in taste, ulceration, bleeding, and systemic infection (Eilers & Epstein, 2004). Mucositis also can alter or delay treatment plan and contribute to increased hospital stays (Elting et al.).

Pathophysiology

According to Sonis (2004), mucositis is the inflammation and ulceration of the oral mucosa and submucosa, usually occurring as an adverse effect of chemotherapy and radiotherapy treatment for cancer. The condition can affect up to 100% of patients undergoing high-dose chemotherapy with hematopoietic stem cell transplantation, 80% of patients with malignancies of the head and neck receiving radiotherapy, and up to 40% of patients receiving standard-dose chemotherapy (Graham, Pecoraro, Ventura, & Meyer, 1993; Rubenstein et al., 2004).

The mucosal lining of the oral cavity was previously believed to be particularly susceptible to damage during cancer therapy for two reasons. First, most treatments for cancer cannot differentiate between healthy cells and cancer cells; consequently, both are injured during treatment. Second, chemotherapy typically targets fast-dividing cells such as those lining the mouth and throat, so the cells become damaged during treatment (Sonis, 2007). However, treatment-induced mucosal damage is now believed to occur in five phases.

- Initiation: Direct reversible and irreversible damage to DNA is caused by chemotherapy or radiation therapy.
- Upregulation and message generation: Transcription factors are activated and move to the nucleus of a cell, where they become capable of upregulating to genes that produce effector proteins, which cause tissue injury.
- Signaling and amplification: Some proteins produced during upregulation are aimed at amplifying tissue injury initiated in the previous phase.
- Ulceration: Ulcers form that can penetrate the epithelium into the submucosa, causing pain and dysfunction.
- Healing: The biologic process occurs through which the epithelium forms an intact surface over mucosal ulcers (Sonis, 2004) (see Figure 1).

Mucositis and Oral Care

Aside from cryotherapy used with bolus 5-fluorouracil and high-dose melphalan, no agent has proven to prevent mucositis in patients receiving chemotherapy (Multinational Association of Supportive Care in Cancer [MASCC], 2005; Worthington, Clarkson, & Eden, 2007). However, research indicates that adherence to an oral care protocol can aid in the reduction and severity of mucositis (MASCC). Because mucositis can have devastating consequences for patients, nurses should take action. First,
incorporating evidence-based guidelines into practice is vitally important. Second, nurses must ensure that their patients have the information, materials, and supplies needed to take an active role in assessing and managing their mucositis.

**Procedure**

As nurses on an inpatient oncology unit, the authors encountered mucositis as a recurring, devastating issue. Interventions centered around the management of symptoms as they arose but were limited, palliative in nature, and ineffective. The authors sought evidence-based preventive measures to incorporate into their practice or other evidence-based treatments that could help their patients manage mucositis.

**Research**

First, the authors identified and explored interventions nurses could employ to assist in the prevention and treatment of mucositis. The Oncology Nursing Society recommended instituting an oral care protocol with education for all patients receiving chemotherapy (Harris, Eilers, Harriman, Cashavelly, & Maxwell, 2008; MASCC, 2005).

The authors searched for articles detailing oral care protocols used at other facilities. Two protocols by Larson et al. (1998) and Raheem et al. (2000) contained the elements sought by the authors and were incorporated into the authors’ protocol. Larson et al.’s PRO-SELF Mouth Aware program was written as a result of the outcome of a study conducted by Dodd et al. (1996) that tested the effectiveness of two mouthwashes (chlorhexidine and sterile water) used with a nurse-taught, systemic oral hygiene program. Nurses were taught to use the Oral Assessment Guide (Eilers, Berger, & Peterson, 1988) to instruct their patients on examination of the oral cavity. Patients were taught, supervised, and evaluated through a return demonstration on how to care for their mouths at home so they could take charge of their oral health. The program included detailed instructions on brushing and flossing, rinsing the mouth with water, inspecting the mouth, and when to call the nurse. Instructions also were detailed for denture wearers and included the nurse’s name and phone number. Raheem et al. incorporated an oral assessment guide as well as interventions based on a score. This resource closely resembles the protocol developed by the authors.

Finally, the authors gathered evidence on which mouth rinse to incorporate in the protocol. The authors sought a solution that did not need to be prescribed by a physician, was readily available, and was cost effective in the clinical setting as well as for patients at home. Many solutions had been identified as possible options, including normal saline, sodium bicarbonate, and water. Each showed similar results when tested and none needed a physician’s prescription. Likewise, all were readily available and were cost effective. The authors chose normal saline for the protocol because a patient in the home can easily prepare normal saline by adding table salt to water. The benefit of saline is its ability to enhance oral lubrication directly as well as by stimulating the salivary glands to increase saliva flow (National Cancer Institute, 2007). In addition, saline can help loosen oral debris (Harris et al., 2008), which can irritate oral mucosa.

**Development and Implementation**

**Oral Assessment Guide**

The basic set-up of the Christie Hospital guide (Raheem et al., 2000) was changed to correspond to the needs of the authors’ patient population (see Figure 2). The guide reflects assessment of the following categories: swallowing and chewing, lips and corners of mouth, tongue, mucous membranes and gums, saliva, teeth and dentures, and oral comfort. Each category is separated into levels of dysfunction, with each level given a numeric score from 0 (no dysfunction) to 3 (major dysfunction). Some categories do not have a third score because they cannot have additional dysfunction; for instance, saliva can be normal (0), thick (1), or absent (2), with no further dysfunction possible. The final score is the highest numeric score in any given category, rather than cumulative. This allows for ease of completion and negates the effects of addition error. The oral assessment is done daily on every patient who meets protocol criteria: neutropenic patients (absolute neutrophil count 500 or less), patients with head and neck cancer, patients receiving radiation therapy to the head and neck, and...
patients receiving chemotherapy. The criteria were selected based on evidence collected from the review of research findings. Although all chemotherapeutic agents do not have the same potential to initiate mucositis, the authors believed that the oral care protocol would benefit any patient receiving an immunosuppressive agent. Therefore, all patients admitted for chemotherapy meet the criteria for placement on the oral care protocol, regardless of the agent.

The scoring key at the bottom of the assessment guide instructs the nurse on which oral care protocol to place the patient and what to teach the patient about proper oral care. A score of 0 places the patient on the standard protocol. Scores 1–3 place the patient on the at-risk protocol, and scores 2–3 also require the nurse to contact the physician with an update on the condition of the patient’s oral cavity and to investigate specific interventions based on patient need. Interventions can range from opioid analgesics to medication for infection. The categories swallowing and chewing and oral comfort also contain a footnote by specific levels of dysfunction that instructs the nurse to contact the physician for a dietary referral. Oral comfort was included as an indicator to the nurse and the physician that the patient has issues with mouth pain because of mucositis but does not replace the hospital’s pain assessment policy.

### Protocols

The authors’ protocol consists of two levels of intervention, the standard care and at-risk protocols. The standard care protocol is initiated on every patient who meets the criteria (see Figure 3). The at-risk oral care protocol is initiated on patients whose oral assessment is scored at 1 or higher (see Figure 4). Both protocols are laminated and displayed prominently over the sink in each patient’s hospital room so patients have easy access to them at all times. The protocols are in vivid color and contain illustrations to draw attention to them and make them appear less clinical. The protocols differ in the frequency that patients rinse their mouths with normal saline and brush their teeth.

### Visual Aids

Visual aids were incorporated into the protocol as a teaching tool for patients as well as nurses. The aids display actual oral dysfunction and act as a prompt to patients, referencing for what to examine in their mouths. The aids also are laminated and are displayed in vivid color above the sink in each patient’s hospital room and on the bedside clipboard for the nurse to reference. The authors believed that the addition of visual aids was important for protocol education and understanding and acted as a deterrent to not performing meticulous oral care during highly susceptible times in the treatment regimen.

### Oral Care Kit

The authors believed an oral care kit would prompt patients as well as nurses...
to initiate the protocol and make supplies readily available for immediate use. The kit also is a tangible “gift” to patients that conveys nurses’ concern for their oral care and hope that they will continue the protocol outside of the hospital. The kit contains the following items in a small gift bag: a soft toothbrush, toothpaste, dental floss, a 250 cc bottle of normal saline, 5–10 small plastic medication cups, a penlight, a tongue blade, a pamphlet containing a miniature version of both protocols, and an index card with a recipe for saline solution that can be made at home.

Each patient meeting the protocol criteria on admission is given the kit, and the nurse initiates education at that time. Education then becomes ongoing reinforcement was provided throughout the hospital stay. Council members addressed the issues by including the oral assessment guide in admission packets. The guide would be available readily on patients’ bedside clipboards, and the presence of the form hopefully would prompt staff nurses to consider placing a patient on the oral care protocol at any time during the hospital stay.

In 2009, organizational changes outside the unit increased the admission of patients who are neutropenic or are receiving chemotherapy. A longer-range goal of the council will be to determine whether every patient admitted to the unit should be enrolled in the oral protocol; as a result, identifying which patients qualify for the oral care protocol may not be necessary.

The hospital’s nursing schedule lengthened the time required to educate all staff nurses. Most nurses work an alternating schedule of seven days on and seven days off, meaning that a separate nursing staff works the opposite week schedule. Reinforcing staff education continues as outlined previously.

The visual aids displayed in the patients’ bathrooms were criticized by some patients and staff. The colorful and realistic depictions of the forms of mucositis were described as too graphic. An e-mail survey asked staff to vote to either remove or retain the bathroom visual aids. Patients were not surveyed formally, but some voluntarily criticized the aids. The staff was closely split in their opinions; as a compromise, only one page of the least-graphic visual aids was displayed. To date, no additional criticism of the photos has occurred.

**Conclusions**

Because mucositis is an issue frequently seen in patients at the authors’ hospital, researching the best interventions to manage the devastating treatment side effect was crucial. By researching the causes and treatments of mucositis as well as what other facilities were doing, the authors developed a protocol that nurses could initiate. The oral care protocol is straightforward and easy to understand, with an oral assessment guide and interventions based on a score. Normal saline as a mouth rinse with brushing, flossing, and inspecting the oral cavity is the basis of the protocol. By initiating the protocol, the authors hope to reduce the incidence and severity of mucositis in patients receiving treatment for cancer. To date, the authors have not done a formal study to assess the effectiveness of the protocol; however, the authors plan to

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1. Brush your teeth with a soft toothbrush for 90 seconds four times a day. 
2. Floss your teeth once a day if your platelet count is greater than 50,000 (ask your nurse). 
3. Rinse your mouth with 15–30 ml normal saline for 30 seconds every four hours after brushing and flossing your teeth and as needed throughout the day. Swish thoroughly and spit out. Do not swallow. Request a new bottle of normal saline daily. 
4. Using your flashlight, inspect your mouth, including your lips and tongue, once a day. Refer to the photos in your bathroom. Call your nurse as soon as possible if you have any mouth problems. 
5. Dentures: Remove your dentures twice a day. Follow steps 1–4, then clean your dentures with a brush and rinse with normal saline. 
6. Talk to your nurse if you have any questions.

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**Figure 3. Standard Oral Care Protocol**

*Note. Figure courtesy of Froedtert Memorial Lutheran Hospital. Used with permission.*

**Figure 4. At-Risk Oral Care Protocol**

*Note. Figure courtesy of Froedtert Memorial Lutheran Hospital. Used with permission.*
conduct a before-and-after implementation comparison on chart review in the future.

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