The Pediatric Oncology Team’s Perception of Oral Health

BY

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THESIS

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SUMMARY

The purpose of this study was to determine comfort levels of pediatric oncologists in recognition of oral health effects of cancer therapy. Hospitals in the greater Chicago area with pediatric oncology departments were contacted for participation in the project. At each participating hospital, a pre-assessment was given to attendees addressing their beliefs, comfort, and knowledge of oral health, pertaining to cancer therapy. After survey completion, a lecture addressing oral health, the caries process, prevention, and side effects of cancer therapy was delivered. Attendees then completed a post-assessment to comparatively assess cancer-related knowledge.

This study found that providers' previous education in oral health, either in residency or continuing education, was not significantly correlated with their comfort in recognizing oral-related cancer side effects. Providers' belief that oral health was important was not significantly correlated with their comfort in recognizing oral-related cancer side effects or rate of performed oral assessments. The belief of oral health importance did significantly increase providers' likelihood of referring patients to a dentist. The providers comfort in recognizing oral health side effects, providing oral hygiene, non-cariogenic diet instructions, and belief that oral health is important significantly increased from the pre-assessment to the post-assessment. Lastly, it was found that the providers' rank of oral health importance increased from the pre-assessment to the post-assessment.

These results indicate that the a one-time training session can improve providers' comfort levels in recognition of oral side effects of cancer therapy in the short term.
SUMMARY (continued)

However, the improvement may only be in the short term, as the previous oral health education was not significantly correlated with comfort of recognition of oral health side effects of cancer therapy. This may indicate the need for repeated educational intervention in order to gain further comfort practicing the information that has been presented.
1. INTRODUCTION

1.1 Background Information

The incidence of all types of cancer in children aged 0-19 is 16.9 per 100,000 persons. However the death rate for the same age group is only 2.4. Survivorship of children after treatment for cancer has increased (U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute, 2013). Children with cancer often undergo treatment regimens that include chemotherapy, radiation, and transplantation (American Academy on Pediatric Dentistry Clinical Affairs Committee & American Academy on Pediatric Dentistry Council on Clinical Affairs, 2014). There are many well documented oral health side effects related to cancer therapy, some of which specifically affect the pediatric population. Although some of the effects of cancer therapy on the oral health can exhibit themselves during treatment, many may not exhibit themselves until years after the chemotherapy and radiation has been discontinued. These conditions include oral mucositis, xerostomia, increased risk for caries, bacterial or fungal infection, oral bleeding, dental developmental anomalies, and graft versus host disease. The short and long-term effects of treatment on the oral health need to be discussed with this patient population (American Academy on Pediatric Dentistry Clinical Affairs Committee & American Academy on Pediatric Dentistry Council on Clinical Affairs, 2014). The American Academy of Pediatric Dentists (AAPD) has created guidelines outlining the oral health effects related to cancer therapy as well as treatment recommendations for each condition. The AAPD recommends that a pediatric dentist evaluate and remove any possible sources of infection or irritation prior to the initiation of cancer therapy. In
addition, the guidelines outline the proper treatment timing if emergency treatment needs to be completed while the patient is undergoing cancer therapy. While there are well-known short and long-term oral side effects in pediatric patients undergoing cancer therapy, there appears to be a lack of consistent oral health anticipatory guidance being provided to this patient population.

1.2 **Purpose of the Study**

Aims of this study:

1. To assess the self-reported comfort and knowledge levels of pediatric oncology providers in assessing oral health side effects, providing anticipatory guidance to their patients, and appropriate dental referral timing.
2. To provide information to the providers to improve their comfort level and knowledge of the oral health side effects.

1.3 **Null Hypotheses**

1. Providers who have had training in oral health, either in medical school/residency or as continuing education, will report the same level of comfort in recognizing oral conditions associated with cancer and cancer therapy as those who did not have training.
2. Providers who report that oral health is very important:
   a) will not show a higher rate of evaluating the oral cavity.
   b) will not show a higher rate of referral of a patient to their dentist.
   c) will not show a higher mean level of comfort in recognizing oral health effects related to cancer therapy.
3. From the pre-assessment to the post assessment the providers’:

   a) comfort level in recognizing oral health effects related to cancer therapy will be the same.

   b) belief that oral health is important in pediatric oncology patients will be the same.
2. REVIEW OF LITERATURE

2.1 Caries and the Pediatric Oncology Patient Overview

Multiple studies have addressed the caries prevalence in the pediatric oncology patient population. F. Dens et al. (1995) examined fifty-two children who had undergone cancer therapy for caries, gingival health, and oral hygiene and compared them to sixty children of comparable age, race and social class who had no history of illness. The study found that caries prevalence was greater in the 14-17 year old study group and a decreased restorative index for the 10-13 year old study group. In the 6-9 year old group, the study population had a lower restorative index. Analysis of gingival health and oral hygiene indicated that the study and control populations had similar findings. This study demonstrated that children who have undergone cancer therapy, particularly as they age, may be at increased risk for caries. However, their oral hygiene practices and gingival health were comparable to their peers (Dens, Boute, Otten, Vinckier, & Declerck, 1995).

A similar study was completed at Uludag University in Bursa, Turkey by Çukukçu and Sevenir in 2007. Patients who had a history of cancer therapy but were disease-free at least five years were selected and compared to a matched control group for age and gender from the population register. The groups were examined for caries and DMFT/dmft was collected from a chart review by one of the authors. This study found an increase in the caries rates of the cancer group and in those children who had undergone head and neck radiotherapy. This study confirmed that childhood cancer
patients and in particular, the population that has radiotherapy as part of their treatment, are at increased risk for caries (Cubukcu & Gunes, 2008). The increased risk for caries in the childhood cancer patient demonstrates the need to insure children are referred for oral health care.

**Specific Oncologic Treatment-Related Oral Health Side-effects:**

### 2.2 Xerostomia and the Oncology Patient

Xerostomia is an additional common side effect to cancer therapy, which can be very uncomfortable to the patient and also puts the patient at increased risk for caries. Treatment of xerostomia may include mechanical and gustatory stimulation, medication, and acupuncture methods of treatment for patients with residual salivary function to increase salivary flow. For those patients who have lost salivary function or the residual function is very low, salivary replacements and other oral products created for patients for xerostomia to improve their comfort such as “Fresh, light acidic fruits, cold cucumber, and tomato slices,” as well as chewing gum to help stimulate salivary function are recommended. Nieuw Amerongen and Veerman confirmed that there are many treatment options developed to treat xerostomia that can be recommended to the childhood cancer patient (Nieuw Amerongen & Veerman, 2003). The present study also included education about xerostomia and its treatment in the intervention to inform the oncology team of treatment options.
2.3 **Oral Fungal Infections and the Oncology Patient**

In 2002, a Cochrane review was performed to determine the effectiveness of prophylactic nystatin use in the immunosuppressed population. The review concluded that prophylactic use of nystatin was not recommended in the treatment of the immunosuppressed patient, as it has not reduced mortality, invasive infection, colonization or harms to the patient (Gotzsche & Johansen, 2002). This finding is consistent with recommendations made by the AAPD and was thus included in educational intervention delivered in the present study.

2.4 **Oral Mucositis and the Oncology Patient**

Oral mucositis is a very uncomfortable side effect that is commonly experienced by patients undergoing cancer therapy. The American Cancer Society (ACS) and a panel of dentists, medical physicians, and nurses established guidelines for methods of prevention and treatment modalities. There are no specific treatments aimed at the pediatric population, however the most recently published guidelines strongly recommended the use of cryotherapy, keratinocyte growth factor-1, benzdymine mouth wash, and low level laser therapy for prevention of oral mucositis and patient controlled analgesia with morphine for treatment of oral mucositis. Each intervention is based on the type of cancer treatment the patient is undergoing. Other recommendations include zinc supplements and oral care protocols for prevention and transdermal fentanyl and morphine or doxepin mouthwashes can be used for treatment of oral mucositis. ACS recommended against the use of polymixin, tobramycin, and amphotericin mouthwash, antimicrobial mouthwash, sulcrafate mouthwash, and intravenous gluatamine for
prevention or treatment of oral mucositis (Keefe et al., 2007). No treatment has been found to prevent oral mucositis in all cases.

2.5 Dental Developmental Effects

Burke and Frame published a case report in 1979 describing the effects of radiotherapy on the developing dentition. The patient experienced increased caries and had premature loss of primary and permanent teeth as a result. The patient also presented with affected adult dentition, including conical shaped lateral incisors and shortened, tapered roots of all eight incisors and first mandibular molars. Upon microscopic examination of extracted teeth, a distinct line was found in the enamel that corresponded to the time of the radiation treatment. Although this study was a case report, it brought attention to the developmental effects of radiotherapy on tooth development. The teeth affected correspond to the teeth that were calcifying and growing roots at six months of age, the time at which she received treatment. Teeth that developed after the completion of treatment were unaffected clinically (Burke & Frame, 1979).

In 2009, Hutton et al. completed a case control study that examined the oral health of pediatric cancer survivors in the UK. This study included patients that had completed their therapy and had chemotherapy as part of the treatment, excluding those that had radiotherapy to the head and/or neck specifically compared to national public domain data as the control. There were increased numbers of microdontia in the cancer therapy population when compared to the control population. This study also confirmed that chemotherapy and radiotherapy have effects on the dentition developing.
at the time of therapy, resulting in abnormal dental anatomy, particularly microdontia (Hutton, Bradwell, English, & Chapple, 2010).

2.6 Late Effects of Cancer Therapy

As treatment regimens have become more successful and more children are surviving childhood cancer, a number of late effects have become more evident. It is estimated that 66% of survivors will experience at least one late effect of cancer therapy and that 25% of these effects will be severe or life threatening. As a result, the AAP recommends the childhood cancer survivor to follow up regularly with a team of specialists to help prevent or diagnose the early stages of complications. Many treatment centers have developed survivorship clinics, providing access to several subspecialists in one place. The late effects experienced by this population may present in the oral cavity and may include dental developmental abnormalities, such as microdontia, poor root development, and enamel dysplasia. The salivary glands may also be affected, leading to lifelong decreased salivary function and xerostomia, associated with higher levels of caries. Increased periodontal disease and osteoradionecrosis of the jaws can also occur. These late effects necessitate regular follow up, at six-month intervals, with a dentist as a childhood cancer survivor ages. The AAP guidelines indicates that follow up may be affected by survivors’ poor understanding of the history of their cancer and its therapy because it may have happened at such a young age. Regular follow-up with specialists can help the survivor as they transition from pediatric care to adult care (American Academy of Pediatrics Section on Hematology/Oncology Children's Oncology Group, 2009).
In 2006, Oeffinger et al completed a retrospective cohort study that surveyed the health conditions of adult survivors of childhood cancer and that of their siblings. This study found that 62% of survivors reported having at least one chronic health condition and were 3.3 times more likely than their siblings to have at least one chronic health condition. The study also found that women were more likely to experience chronic health conditions, as were those who were older at the time of diagnosis (Oeffinger et al., 2006).

2.7 Dental Management of the Pediatric Oncology Patient

The AAPD has developed a set of clinical guidelines on the management of pediatric cancer patients based on published literature. The most recently published guidelines address the many oral side effects related to cancer therapy. They recommend a comprehensive oral examination prior to the initiation cancer therapy to allow for the dentist to stabilize the condition of the oral cavity by removing any source of infection, to communicate with the oncology team, and to provide anticipatory guidance to the parents regarding the oral effects of cancer therapy, both acute and long term. Management of the patient includes prevention, treatment of oral complications during cancer therapy, and management of oral complications after completion of treatment.

A study completed by Sonis and Kunz in 1988 in Boston, compared cohorts of cancer patients from charts from an era prior to institution of aggressive oral health protocols (prior to 1978) to an era characterized by aggressive oral health protocols (1978-1988). Patients’ charts were examined for treatment and oral complications. If
the patient did not receive a treatment known to have oral complications, they were excluded from the study. A total of 465 charts were examined. Oral complications were noted in 13% of the more recent patient group, as compared to earlier group, previously reported at 39%. This study supports increased collaboration between the oncology team and dentists to decrease oral side effects during cancer treatment (Sonis & Kunz, 1988).

2.8 **AAPD Guidelines for Oral Prevention**

The importance of prevention during cancer therapy should be addressed, as any infection can be life threatening while the patient is immunosuppressed. The AAPD recommends that dentists should advise the patient to continue brushing 2-3 times daily with fluoride and a soft nylon brush, and to continue flossing if the patient is skilled enough. If the patient cannot tolerate fluoride due to mucositis, non-fluoridated toothpaste can be used temporarily, but fluoridated toothpaste should be resumed as soon as the patient can tolerate it. Parents should be warned of the sugar content of many pediatric medications and dietary supplements, and a non-cariogenic diet reviewed (American Academy on Pediatric Dentistry Clinical Affairs Committee & American Academy on Pediatric Dentistry Council on Clinical Affairs, 2014).

In order to reduce the severity of trismus for those patients who will undergo radiation to the head and neck area, patients should be given daily oral stretches to complete or prostheses to wear. If trismus develops and provides a challenge to these patients, trigger point injections, muscle relaxants, and pain-management can be provided. Lead-lined stents can be provided to patients who will undergo radiation to
the head and neck region to reduce trismus, and also xerostomia (American Academy on Pediatric Dentistry Clinical Affairs Committee & American Academy on Pediatric Dentistry Council on Clinical Affairs, 2014).

Xerostomia can be very uncomfortable to the patient and is also a caries risk. Patients can be advised to use salivary substitutes, fluoride rinses, or sugar-free candies to stimulate salivary function. Treatment of teeth with infections may need to be aggressive, electing extraction rather than pulpotomies in primary teeth to prevent complication during cancer therapy (American Academy on Pediatric Dentistry Clinical Affairs Committee & American Academy on Pediatric Dentistry Council on Clinical Affairs, 2014).

2.9 AAPD Guidelines for Dental Treatment During Cancer Therapy

Dental treatment during cancer therapy should be limited to urgent care and careful consultation with the oncology team should be completed to ensure the patient’s hematologic and immune statuses are appropriate for treatment. Patients should continue to see their dentist every six month for examination, but elective treatment should be delayed until the patient is done with cancer therapy. Orthodontic treatment and any other type of appliance that is not well adapted should be removed, especially if the patient is unable to maintain good oral hygiene. Extractions should be done only after careful consideration for patients whose treatment regimens include radiation to the head and neck or bisphosphonates and they should ideally be completed two weeks prior to the initiation of treatment. If patients develop oral mucositis, palliative treatment
should be considered and oral hygiene stressed. Mucosal infections may develop during immunosuppressed periods and any suspicious lesion should be biopsied or cultured for appropriate treatment. Oral bleeding may occur and can be managed first by local measures with pressure packs or topical agents, and then systemic agents if necessary. Patients may also experience dental pain or sensitivity, which can be related to xerostomia or to their treatment regimen. Those patients whose regimens include plant alkaloids may experience a deep, constant pain in the mandibular jaw in the absence of odontogenic pathology. These patients can be advised that the pain will diminish after the dosage is decreased or stopped (American Academy on Pediatric Dentistry Clinical Affairs Committee & American Academy on Pediatric Dentistry Council on Clinical Affairs, 2014).

2.10 **AAPD Guidelines on Dental Treatment After Cancer Therapy**

After patients have completed their cancer therapy, they should continue to be examined by a dentist every six months, or more frequently if they are at risk for graft-versus-host disease (GVHD) or had severe oral mucositis, which may be an increased risk factor for secondary malignancy. Treatment of any continuing side effects, for example xerostomia or trismus, may continue as provided during treatment. Patients will also be monitored for future development of dental anomalies, such as microdontia and underdeveloped crowns or roots. Patients who undergo stem cell transplant are in an immunosuppressed state for a much greater period of time, and thus must be managed more conservatively than other cancer therapies. The side effects of their treatment are generally the same, although they may be more prone to GVHD, growth

2.11 Orthodontic Treatment of the Pediatric Oncology Patient

With an increased number of survivors of childhood cancer, more patients seeking orthodontic treatment have cancer therapy as part of their medical history. Several studies have examined the relationship between cancer therapy and orthodontic treatment. A study by Dahllöf et al. reported that a past medical history of cancer influenced orthodontists’ treatment plan to use light forces to minimize root resorption, end treatment earlier, and use the simplest method for treatment (Dahllof, Jonsson, Ulmner, & Huggare, 2001).

2.12 Caregivers of Pediatric Oncology Patients

When a child is diagnosed with cancer, the entire family is affected. Parents may become overwhelmed with the medical diagnosis and overlook the importance of the oral health of the child. A study by Çubukçu and Günes in 2007 in Turkey examined parental knowledge and attitudes about dental care in the pediatric oncology patient. The study found that there was need for increased parental dental knowledge, with correct responses to the knowledge questions varying from very low to barely adequate. All parents in the study reported that the child had been seen by a dentist prior to the cancer diagnosis and had received anticipatory guidance about oral hygiene and diet at
these visits. After diagnosis, almost all reported receiving this same type of information. Ninety percent of the parents reported that they had not been referred to the dentist between the initial cancer diagnosis and prior to the initiation of cancer therapy. After treatment began, 90% of patients continued to be seen for periodic oral examinations and with the rest seen only when they were experiencing oral complications. Over half of parents reported that their attitude toward oral health and oral hygiene practices changed after their child’s cancer diagnosis. The majority of the parents also reported that they felt more comfortable with their child receiving dental care within the hospital setting for increased convenience and trust. This study confirms the need for parents to be provided repeated anticipatory guidance for the oral health of the cancer patient (Cubukcu & Gunes, 2008).

2.13 Cancer Center Oral Health Protocols

In 2004, Glenny et al. investigated the protocols followed by 22 United Kingdom Children’s Cancer Study Group centers regarding the oral health of their patients. The primary investigator found that 87% of the centers used a published guideline for oral health within their clinic and 68% felt the guidelines were used consistently. Possible reasons for non-adherence to the guidelines include compliance of the patient, preference of the consultant, staff awareness of the guidelines, and limited time available during appointments. Evaluation of the oral cavity was addressed in 68% of the protocols and prevention guidance in 84%. Only 23% of the centers had a member of the staff or group designated to respond to oral issues and only one of the centers had a dentist on staff. The majority of the centers (91%) were recommending the use of
a soft toothbrush, but the guidance provided about frequency of brushing, using a fluoridated toothpaste, and frequency of toothbrush replacement was inconsistent. The use of prophylactic anti-fungal medications, ice chips, and chlorhexidine also varied greatly between centers. Approximately two-thirds of the cancer centers provided oral hygiene products to their patients and reviewed oral care regimen with the patient at the conclusion of treatment. Only 41% of the centers recommended that patients visit their dentist at the time of diagnosis and continue to see the dentist every six months. Oral education provided to the nurses by the 96% of the centers at some point, but was only reviewed regularly in about two-thirds of the centers. All of the centers indicated that nationally developed evidence-based guidelines for oral health in the cancer patient. This study also found that nurses were primarily responsible for providing oral health instructions to the patients, making this a target population for continuing education. Although this study was done in the UK, it is important in pointing out that medical professionals often do not have the same knowledge of the oral cavity as dental professionals and they feel that having guidelines that were reviewed regularly would be helpful in managing the oral health of the pediatric oncology patient (Glenny et al., 2004).

2.14 Educational Interventions

Educational interventions can affect provider behavior. Kressin et al. completed a study investigating the relationship of early childhood caries (ECC) rates and pediatric clinicians’ provision of oral health anticipatory guidance in 2009. A training session on oral hygiene instructions, non-cariogenic diet recommendations, and other ECC risk
reduction methods was delivered at the study site and compared to a site with no training. The pediatricians at the test site scored higher on the questionnaire after the training session, and were found to provide significantly more counseling related to oral health and ECC. The patients at the study site were also 77% less likely to develop ECC over the one year time period than those at the control site. This study showed that a training session, which is a relatively low cost method of intervention, can significantly increase the anticipatory guidance provided by clinicians and thus have lasting effects on the oral health of their patients (Kressin et al., 2009).

In 2008 a study by Minah et al. was completed evaluating the effectiveness of implementation of a caries prevention program in an at risk population. The patients were followed for 26 months and were found to exhibit less cavitated carious lesions than the comparison group. This study justifies the use of simple preventive methods, like the application of fluoride varnish and more frequent recall, to decrease the rate and severity of ECC (Minah et al., 2008).

Another study evaluated the effectiveness of direct educational intervention with patients on their oral hygiene and caries risk. Zanin et al. in 2007, used the plaque and gingival index to calculate caries risk of children. There were two groups, a control group and an intervention group. The intervention group received four lectures addressing oral hygiene practices and prevention of caries. They were evaluated at baseline, 3, 6, 9, 12, and 15 months and the intervention group had statistically decreased scores and thus decreased caries risk. Again, this study demonstrates the ability of low-cost interventions to improve oral health and decrease caries risk, even over time (Zanin, Meneghim, Assaf, Cortellazzi, & Pereira, 2007).
3. MATERIALS AND METHODS

3.1 Research Design

This study was approved by the Institutional Review Board at University of Illinois at Chicago, protocol number 2013-0649 (Appendix A). This study was completed by giving the hematology-oncology providers at five Chicago area hospital a pre-assessment survey (Appendix B) regarding their 1) beliefs about oral health importance and 2) their comfort level in assessing multiple conditions of the oral cavity, including caries, xerostomia, oral mucositis, trismus, and oral infections. These oral conditions are those that are addressed in the AAPD guidelines as commonly occurring in patients undergoing cancer therapy. The survey also asked demographic questions about provider-type, years in practice, previous training in oral health, dental referral practices, and oral cavity evaluation. A lecture was then delivered on the topics of basic caries pathology, oral hygiene, non-cariogenic diet, dental treatment during cancer therapy, and oral health side effects of cancer therapy (Appendix C). A post-assessment survey regarding changes in provider beliefs about oral health importance and their comfort level in assessing the same oral health conditions of the oral cavity was then given.

3.2 Inclusion Criteria

Eligible subjects were physicians, fellows, advanced-nurse practitioners, nurse practitioners, and other health care providers involved in the cancer therapy treatment of pediatric oncology patients, under the age of 26, at University of Illinois at Chicago.
Hospital, Rush Hospital, Lurie Children’s Hospital, Advocate Children’s Hospital, and Loyola University Chicago Hospital. All providers in attendance of the lecture were informed that their participation was voluntary and to please return the surveys blank if they did not wish to participate.

3.3 Subject selection, recruitment, and documentation of informed consent

Pediatric hematology-oncology departments throughout the city of Chicago were invited to participate in a lecture and survey about the oral conditions related to the therapy they provide to their patients. The surveys were distributed at the beginning of the lecture, which were scheduled by the individual pediatric hematology/oncology departments at participating university hospitals in the Chicago, Illinois area. An instruction sheet and cover letter explaining the purpose of the study was included on the front of the survey, which specifically addressed the element of consent. The participant selection was by convenience and voluntary. Providers completed the pre-assessment survey, listened to the presentation about oral health of the cancer patient, and then completed the post-assessment survey. The pre- and post-assessment surveys were handed out together, with matching ID numbers on them. The participants were asked to complete the pre-assessment (labeled 1A) prior to the lecture and the post-assessment (labeled 1B) after completion of the lecture. The participants were then asked to place both assessments in the original, unidentifiable envelope, even if they did not wish to participate.
3.4 **Rationale for selection of subjects**

The subjects chosen for this study are influential in the referral and treatment of pediatric oncology patients. Providing education to this population may help to improve the oral outcomes of the pediatric oncology patients.
4. RESULTS

4.1 Number of Respondents and Response Rate

Five of the six hospitals contacted agreed to allow the survey and lecture be conducted. At one of the hospitals, multiple attempts were made by both the primary investigator and a member of the committee, to schedule a training session without success. A total of forty-eight surveys were handed out to attendees of the lecture and forty-three were returned, for a response rate of 90%. All forty-three participants met the inclusion criteria.

4.2 Descriptive Data for Respondents

The majority of the respondents were female and nurses. There were also a large number of those in the “other” category, which includes medical students, residents, and office staff. Majority of the respondents report that they had education in oral health during their training and had completed some continuing education in oral health. Most respondents indicated that they do refer their patients to the dentist prior to the initiation of cancer therapy. The results indicate that the participants evaluate the oral cavity at most visits, refer to the dentist during treatment sometimes and ask if the patients have a Dental Home sometimes. Demographic data for the respondents can be found in Tables I-IV. The mean years in practice of the respondents was 11.5±11.1 years.
**TABLE I**

GENDER OF PROVIDERS IN ORAL HEALTH EDUCATION SESSION

<table>
<thead>
<tr>
<th>Gender</th>
<th>Percentage</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Female</td>
<td>86</td>
<td>37</td>
</tr>
</tbody>
</table>

**TABLE II**

POSITION OF PROVIDERS IN ORAL HEALTH EDUCATION SESSION

<table>
<thead>
<tr>
<th>Position</th>
<th>Percentage</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending Physician</td>
<td>21</td>
<td>9</td>
</tr>
<tr>
<td>Fellow</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Nurse</td>
<td>44</td>
<td>15</td>
</tr>
<tr>
<td>Other</td>
<td>28</td>
<td>12</td>
</tr>
</tbody>
</table>

Other includes medical students, residents, and office staff

**TABLE III**

OH TRAINING AND REFERRAL OF PROVIDERS IN ORAL HEALTH EDUCATION SESSION

<table>
<thead>
<tr>
<th>Baseline Education and Referral</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuing Education</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>Oral Health in Training</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Dental Referral Prior to Treatment</td>
<td>30</td>
<td>13</td>
</tr>
</tbody>
</table>
### TABLE IV

**DENTAL PRACTICES OF PROVIDERS IN ORAL HEALTH EDUCATION SESSION**

<table>
<thead>
<tr>
<th>Baseline Provider Frequency</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Assessment</td>
<td>3.1</td>
<td>±1.0</td>
</tr>
</tbody>
</table>

Scale 1=Never, 2=At some visits, 3=At most visits, 4=At all visits

### TABLE V

**DENTAL PRACTICES OF PROVIDERS IN ORAL HEALTH EDUCATION SESSION**

<table>
<thead>
<tr>
<th>Baseline Provider Frequency</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referral to Dentist</td>
<td>2.5</td>
<td>±1.3</td>
</tr>
<tr>
<td>Identify Dental Home</td>
<td>2.4</td>
<td>±1.4</td>
</tr>
</tbody>
</table>

Scale 1=Never, 2= Sometimes, 3=Often, 4=Most of the time, 5= Always
4.3 Analysis of Hypothesis 1: Oral Health Education and Comfort in Recognizing Oral Side Effects

Those respondents who had training in oral health, either in medical school, residency, or as continuing education were compared to those who did not for recognition of oral conditions associated with cancer and cancer therapy, namely xerostomia and oral mucositis. Oral health education was not correlated with comfort in recognizing oral mucositis (U=85.5, p=0.5) or xerostomia (U=100.5, p=0.9), using the Mann Whitney U.

4.4 Analysis of Hypothesis 2: Oral Health Beliefs and Oral Exam

The provider’s belief that oral health was very important did not significantly correlate with their frequency of oral cavity assessment (r=0.3, p>0.05) using Pearson’s correlation.

4.5 Analysis of Hypothesis 3: Oral Health Beliefs and Dental Referral

The provider’s belief that oral health was very important did significantly correlate with their frequency of dental referral (r=0.33, p=0.04), using Pearson’s correlation.
4.6 Analysis of Hypothesis 4: Oral Health Beliefs and Comfort in Recognizing Oral Side Effects

The provider’s belief that oral health was important was not significantly correlated with comfort in recognition of oral mucositis ($r=-0.19$, $p=0.2$) or xerostomia ($r=-0.18$, $p=0.3$), using Pearson’s correlation.

4.7 Analysis of Hypothesis 5: Comfort in Recognizing Oral Side Effects Before and After Lecture

The provider’s comfort in recognizing oral mucositis significantly increased from a mean of 4.1±1.2 prior and a mean of 4.5±0.8 after the lecture on a 5-point Likert scale, ranging from not comfortable to extremely comfortable ($Z=-2.58$, $p=0.01$), using Wilcoxin sign ranks test. The provider’s comfort in recognizing xerostomia also significantly increased from a baseline mean Likert of 2.6±1.2 to mean of 3.9±1.0 after the lecture, again on a Likert scale of 1, meaning not comfortable, to 5, meaning extremely comfortable ($Z=-4.61$, $p=0.00$), using Wilcoxin signed ranks test. See Figure 1.

4.8 Analysis of Hypothesis 6: Oral Health Beliefs Before and After Lecture

The belief that oral health is important significantly increased from a baseline mean Likert scale (1=not important, 5=extremely important) of 4.2±0.4 to a mean of 4.7±0.5 after the lecture ($Z=-5.000$, $p=0.000$), using Wilcoxin signed ranks test. See Figure 1.
Figure 1

Pre- and Post-Assessment Measures

![Bar chart showing comfort levels for various oral health measures pre- and post-assessment.](chart.png)
5. DISCUSSION

Long-term survivorship of childhood cancer has increased greatly in the past several years, leading to a new patient population with new complications and considerations. The American Academy of Pediatric Dentistry has outlined guidelines for appropriate treatment of this patient population for dentists. This study demonstrated how one training session can affect the beliefs of medical providers regarding dental care for their pediatric patients.

5.1 Limitations and Strengths of the Study

The major limitation to this study is the number of sites recruited. Some resistance was met from the oncology community when approached by the primary investigator for recruitment. One of the major university hospitals in the city of Chicago that has a very large pediatric oncology department did not allow the study to be completed in their hospital. Multiple attempts were made by the primary investigator, as well as one of the committee members, to contact different people in the department to set up the training and survey session, and all attempts were unsuccessful. This, perhaps, suggests an underlying lack of interest in oral health in the medical field and supports the need for increased interdisciplinary education. Possibly the department feels that they have a qualified individual who is providing the necessary oral health component to their facility. At a second site, the training session was allowed first only to the nursing staff and then to the physicians only after the nurses evaluated the session and provided feedback to the coordinator for the physicians. At most of the sites, the training session was scheduled during times that were not ideal for increasing
attendance. One session was scheduled while clinic was in session and people were not released from clinic duties to attend, reducing the total number of participants. At a few other sites, the session was scheduled at the end of the day and participants may have elected to go home rather than attend.

A second limitation is the participants themselves. The number of participants, 43, is a relatively small number for a study. Increased number of participants would increase the power of the study. Also, the participants’ position in the department varied greatly. Ideally, this survey would be geared towards only those who are part of the oncology team on a regular basis, namely physicians, nurses, nurse practitioners, advanced nurse practitioners, and fellows. Exclusion of residents, medical students, and other people rotating through a clinic would be ideal instead. Attendance could, perhaps, be improved if there was motivation for the physicians, fellows, residents, and nurses to attend. Motivation could be internal or departmental and may be related to the education on oral health or the belief that oral health is important. Motivation may also come from offering of some type of giveaway, such as oral hygiene kits or continuing medical education credits.

Another limitation is that this study was only completed in greater Chicago, Illinois. Although the hospitals all serve slightly different patient populations, there are still some biases and attitudes that may be unique to this area. The participant sites may not be representative of all cancer treatment centers within the United States, so the study is limited in its generalizability to other areas of the state or country.

There are also strengths to this study. To date, there are no other studies that examined the perceptions of the pediatric oncology teams’ attitudes, beliefs, and
knowledge of the oral health of their patient. It also provided an opportunity for the development of a relationship between University of Illinois at Chicago Department of Pediatric Dentistry and multiple pediatric oncology departments throughout the city and hopefully improved the future collaboration for comprehensive care of the patients, which could provide a foundation for future research.

5.2 Summary of Findings

The providers’ training in oral health did not significantly increase their comfort in recognizing oral conditions associated with cancer therapy. The provider’s belief that oral health was important did not significantly increase their rate of oral assessment or increase their comfort in recognizing oral conditions associated with cancer therapy, but it did significantly increase their likelihood of referral to the dentist. It is worth noting that although the provider’s belief that oral health is important was not statistically correlated with the frequency of oral assessment, the p-value (p=0.052) was just above the level of acceptance and perhaps with a larger sample size, it may be found that these two variables are correlated. The providers’ comfort level in recognizing oral conditions associated with cancer therapy, and belief that oral health is important, increased from the pre-assessment to the post-assessment. Although caries knowledge was not addressed in the hypotheses, the survey did ask questions about this topic. It was found that the providers’ comfort in understanding the basic caries process, as well as recognition of the caries upon examination, was improved from the pre-assessment to the post-assessment. The providers also reported increased comfort in providing oral hygiene instructions and non-cariogenic diet counseling to the patients from the pre-assessment to the post-assessment.
5.3 **Results of this Study Compared to Previous Studies**

As mentioned previously, there were no studies completed prior to this analyzing the perceptions of the pediatric oncology team regarding the oral health of their patient population. The majority of the previous studies examined the side effects of cancer and cancer therapy and addressed treatment and management practices, generally recommending the involvement of a dentist. Similarly to the present study, several studies found that low-cost interventions, such as training sessions to providers, training sessions to patients, and inclusion of a dental examination by a dentist in a medical setting, can lead to improved oral health outcomes (Kessin et al., 2009, Minah et al., 2008, and Zanin et al., 2007).

5.4 **Significance of the Study**

Although there are explicitly defined treatment and management guidelines available to dentists regarding the treatment of the pediatric oncology patient, no such guidelines or protocols have been found for the oncology team to follow for appropriate referral and treatment timing of dental work. This study provided an opportunity to foster a relationship between pediatric dentists and the pediatric oncology team to collaborate to provide the best treatment for the pediatric oncology patient’s oral health, which is linked to the overall health of the patient. The study found that a training session can improve the oncology team’s comfort level of recognition of multiple oral conditions related to cancer and cancer therapy, provision of oral hygiene instructions and non-cariogenic diet counseling, and understanding the basic caries process. It can
also increase the belief that oral health is important in the pediatric oncology patient. These findings can support continued provision of training sessions to this population to improve oral health outcomes in this patient population. The results also support the need for increased collaboration between pediatric dentists and the oncology team in order to develop a relationship and increase knowledge of both groups, allowing for better treatment of the patient.

5.5 Implications of Future Research

This study could easily be reproducible and improved upon in the future. To improve upon one of the major weaknesses, namely the number of participants, offering of continuing medical education credit may increase participation. Another idea would include creating an online module that could be completed at the convenience of the participant so that timing of the sessions would be less influential. This may also be distributed to a wider area geographically. With a larger number of participants, it would be easier to target the team members who are consistently interacting with the patient population and not just rotating through the clinic as part of their education. Providing oral hygiene kits and demonstration of their proper usage, referral cards, and educational brochures may also be helpful to increase the providers’ recall of the information provided and likelihood of referral. Annual repetition of the training session may also help to improve the retention of the information provided. Another possible route for further exploration would be to examine what motivates and what inhibits providers from making changes in their practices.
6. CONCLUSIONS

The following conclusions can be drawn from the study:

1. Training sessions can significantly improve providers’ recognition of and comfort level assessing oral health conditions in the pediatric oncology patient.
2. A single training session in oral health will significantly increase the providers’ comfort in recognizing oral conditions associated with cancer therapy.
3. Despite providers’ belief that oral health is important, a single educational session inadequately increases providers’ rate of oral assessment.
4. Providers’ belief that oral health is important will not increase their comfort in recognizing oral conditions associated with cancer therapy.
5. Providers’ belief that oral health is important is related to their likelihood of referral to the dentist.


APPENDICES
Exemption Granted

July 5, 2013

Jillian Gray, B.S., D.D.S.
Pediatric Dentistry
801 S Paulina St
M/C 850
Chicago, IL 60612
Phone: (419) 360-0097 / Fax: (312) 413-8006

RE: Research Protocol # 2013-0649
“Pediatric oncologists' comfort with recognition of oral health effects of cancer therapy”

Sponsors: None

Please be reminded of the need to prospectively address institutional approval requirements at each of the non-UIC sites.

Dear Dr. Gray:

Your Claim of Exemption was reviewed on July 3, 2013 and it was determined that your research protocol meets the criteria for exemption as defined in the U. S. Department of Health and Human Services Regulations for the Protection of Human Subjects [(45 CFR 46.101(b)]. You may now begin your research at UIC.

Lead Performance Site: UIC
Other Sites: See text box above
Subject Population: Adult (18+ years) subjects only
Number of Subjects: 100
The specific exemption categories under 45 CFR 46.101(b) are:

(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods; and

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

You are reminded that investigators whose research involving human subjects is determined to be exempt from the federal regulations for the protection of human subjects still have responsibilities for the ethical conduct of the research under state law and UIC policy. Please be aware of the following UIC policies and responsibilities for investigators:

1. **Amendments** You are responsible for reporting any amendments to your research protocol that may affect the determination of the exemption and may result in your research no longer being eligible for the exemption that has been granted.

2. **Record Keeping** You are responsible for maintaining a copy all research related records in a secure location in the event future verification is necessary, at a minimum these documents include: the research protocol, the claim of exemption application, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to subjects, or any other pertinent documents.

3. **Final Report** When you have completed work on your research protocol, you should submit a final report to the Office for Protection of Research Subjects (OPRS).

4. **Information for Human Subjects** UIC Policy requires investigators to provide information about the research protocol to subjects and to obtain their permission prior to their participating in the research. The information about the research protocol should be presented to subjects in writing or orally from a written script. When appropriate, the following information must be provided to all research subjects participating in exempt studies:
   a. The researchers affiliation; UIC, JBVMAC or other institutions,
   b. The purpose of the research,
   c. The extent of the subject’s involvement and an explanation of the procedures to be followed,
   d. Whether the information being collected will be used for any purposes other than the proposed research,
   e. A description of the procedures to protect the privacy of subjects and the confidentiality of the research information and data,
   f. Description of any reasonable foreseeable risks,
g. Description of anticipated benefit,
h. A statement that participation is voluntary and subjects can refuse to participate or can stop at any time,
i. A statement that the researcher is available to answer any questions that the subject may have and which includes the name and phone number of the investigator(s).
j. A statement that the UIC IRB/OPRS or JBVMAC Patient Advocate Office is available if there are questions about subject’s rights, which includes the appropriate phone numbers.

Please be sure to:

¬ Use your research protocol number (listed above) on any documents or correspondence with the IRB concerning your research protocol.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact me at (312) 355-2908 or the OPRS office at (312) 996-1711. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Charles W. Hoehne
Assistant Director
Office for the Protection of Research Subjects

c: Indru C. Punwani, Pediatric Dentistry, M/C 850
Sahar Alrayyes, Pediatric Dentistry, M/C 850
APPENDIX B

Pediatric Oncologists' Comfort With Recognition of Oral Health Effects of Cancer Therapy

Dear Participant,

Thank you for considering participation in the lecture and research project today. I am a pediatric dental resident at the University of Illinois College of Dentistry. The purpose of this study is to determine the level of comfort that providers in pediatric oncology have with oral health and their patients. We have chosen you to participate because you are part of the team providing care to pediatric oncology patients. We expect a total of 100 participants from various pediatric oncology departments throughout Chicago.

The lecture today will provide you with additional knowledge regarding the oral health of pediatric patients in general and pediatric oncology patients in particular, as well as information on the interdisciplinary relationship that should be fostered between pediatric oncology teams and pediatric dental teams. The hope is that improvement in knowledge and working relationships with dentists will benefit our patients. There is no other benefit to the research, and there are no risks to the research.

You are welcome to just listen to the lecture without participating in the research. However, we hope you will agree to fill out an anonymous questionnaire which will take a couple of minutes before and after the lecture, so we can assess your thoughts and the impact of the lecture. If you choose not to participate in the research, please return the questionnaires blank in the envelope provided. Again, participation in this study is completely voluntary and there are no consequences to declining participation.

If you have any questions, you may ask them of me now. If questions occur to you later, you may ask me at jgray@uic.edu or my supervisor Dr. Sahar Alrayyes at salrayy1@uic.edu. If you have further questions about your rights as a research subject or concerns, complaints, or to offer input, you may call the Office for the Protection of Research Subjects (OPRS) at 312-996-1711 or e-mail OPRS at uicirb@uic.edu.

Thanks,

Jillian Gray, DDS
UIC Pediatric Dentistry
Chicago, IL
Pre-assessment questions

Please complete the following before the presentation begins.

1. What is your gender?
   a. Male
   b. Female
2. How many years have you been in practice?

3. What is your position?
   a. Attending
   b. Fellow
   c. Nurse
   d. Other
4. Was oral health a part of your training?
   a. Yes
   b. No
5. Have you taken any continuing education classes regarding oral health?
   a. Yes
   b. No
6. Do you advise patients and their parents to schedule an appointment with their dentist before cancer therapy begins?
   a. Yes
   b. No
7. How often do you ask patients and their parents if they have a dental home?
   a. Never
   b. Sometimes
   c. Often
   d. Most of the time
   e. Always
8. How often do you refer a patient to their dentist?
   a. Never
   b. Sometimes
   c. Often
   d. Most of the time
   e. Always
9. How often do you assess the oral cavity during a patient visit?
   a. Never
   b. At some visits
   c. At most visits
   d. At all visits
10. How important is oral health in pediatric oncology patients?
    a. Not important at all
    b. Slightly important
    c. Moderately important
    d. Very important
11. How comfortable are you in your understanding of the caries process?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

12. How comfortable are you in recognizing dental caries?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

13. How comfortable are you in providing non-cariogenic diet recommendations?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

14. How comfortable are you in providing oral hygiene instructions?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable
   f.

15. How comfortable are you in recognizing oral musositis?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

16. How comfortable are you in recognizing xerostomia?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable
Post-assessment questions

Please complete the following after the presentation is complete.

1. How important is oral health in pediatric oncology patients?
   a. Not important at all
   b. Slightly important
   c. Moderately important
   d. Very important
   e. Extremely important

2. How comfortable are you in your understanding of the caries process?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

3. How comfortable are you in recognizing dental caries?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

4. How comfortable are you in providing non-cariogenic diet recommendations?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

5. How comfortable are you in providing oral hygiene instructions?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

6. How comfortable are you in recognizing oral mucositis?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable

7. How comfortable are you in recognizing xerostomia?
   a. Not comfortable
   b. Somewhat uncomfortable
   c. Neutral
   d. Somewhat comfortable
   e. Extremely comfortable
APPENDIX C

Overview

- Coordination of oral health care with pediatric oncology team is very important
- There are many well known oral side effects to cancer therapy, and some that effect this population specifically

Objectives

- Increase the oncology teams’
  - Knowledge of oral side effects
  - Knowledge of ideal treatment timing
  - Comfort level in recognizing side effects
  - Referral knowledge

- Increase the collaboration in care of the pediatric oncology patient between the oncology team and the pediatric dentist

Outline

- Childhood caries process
- Concerns prior to treatment
- Concerns during treatment
- Concerns after treatment

Early Childhood caries and the basic caries process

Oral Health Care in Pediatric Oncology Patients

Jillian Gray
UCLA College of Dentistry
Department of Pediatric Dentistry

5/21/2014
Early Childhood Caries

- Most prevalent chronic disease of childhood.
- ECC: presence of 1 or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of 6.
- Highly prevalent and increasing in poor/near poor US preschool children.
- Largely untreated in children under age 3.
- Greatest risk indicator of future caries is past caries experience.

Caries process

- Common chronic infectious disease resulting from tooth-adherent specific bacteria.
- Metabolize sugars to produce acid.
- Time demineralizes tooth structure.
- Passed from caregiver to infant through salivary contact or between other members of the family or children in daycare.

Oral considerations before the initiation of treatment

Pre-therapy oral health

- Dental history:
  - Dental home?
  - Routine dental cleanings, radiographs, and preventive care?
  - Pediatric dentist or general dentist?
- Recommend that the patient makes an appointment with their dentist.
- General dentists may feel less comfortable treating a child with cancer.

Pre-therapy oral health

- Basic oral hygiene instruction:
  - Brush the teeth and tongue 2-3 times daily.
  - Soft nylon brushes, regardless of the hematological status.
  - Electronic brushers and floss only for those patients who are skilled at using them to prevent tissue damage.
  - Toothpaste are not effective.
  - May supplement with chlorhexidine mouth rinses if oral hygiene is poor.
  - Replacement of the toothbrush every 2-3 months.
  - Use a flossed toothpaste.
- Sensitivity if oral mucosis develops.
Pre-therapy oral health

- Basic diet instructions:
  - Parents feed their children a caloric rich diet to compensate for weight loss.
  - Caloric rich foods and drinks are also high in sugar and are likely to cause cavities.
  - Juice, milk, and soda are all high in sugar.
  - Fluoridated water between meals.
  - Dietary supplements are rich in carbohydrates.
  - Oral pediatric medications are rich in sucrose/sugars.

Pediatric dentist’s role

- At a pre-treatment exam:
  - Identify potential sources of infection.
  - Aggressively treat.
  - Review oral hygiene instructions.
  - Review non-cariogenic diet.
  - Provide exercises for the patient to prevent trismus.
  - Provide radiation shield (lead-lined stents) if indicated to reduce radiation to healthy oral tissue.

Oral Health During Treatment

- Cancer therapy has multiple side effects related to oral health:
  - Xerostomia
  - Oral mucositis
  - Trismus
  - Oral mucous infections
  - Oral sensitivity/pain
  - Oral bleeding.

Xerostomia

- What is xerostomia?
  - Decrease of the oral fluid.
- Treatment suggestions:
  - Sugar-free chewing gum or candy.
  - Special toothpaste, mouthwashes, and saliva substitutes.
  - Hydration by the bedside at night.
  - Fluoride rinses and gels for caries prevention.

Oral mucositis

- Treatment:
  - Palliative care.
  - Early consultation with a dietitian.
  - Trial of modified diet, enclosure, enteral feeding.
  - Stomatitis, ulcer, or dry mouth:
    - Early consultation with a dietitian.
    - Early consultation with an oncologist.
    - Early consultation with a radiation oncologist.
    - Early consultation with a dermatologist.
  - Includes “mouthwash/foam”:
    - Sessile xenografts, anemia, redness.
    - Oral ulcer IV.
Oral mucosal infections
- Oral cultures/biopsies of suspicious lesions
- Prophylactic medications initiated until more specific therapy prescribed
- Prophylactic Nystatin does not indicated.

Oral Bleeding
- Causes
  - Thrombocytopenia
  - Disturbances of coagulation factors
  - Damaged vascular integrity
- Treatment:
  - Local measures:
    - Pressure pack
    - Anti-inflammatory ointments
    - Colloidal silver
  - Systemic Measures:
    - Platelet transfusions
    - Anticoagulants/antiplatelet drugs

Dental Pain/Sensitivity
- Sensitivity can be related to xerostomia and lowered salivary pH.
- Treated with plant alkaloids, i.e. vinblastine, vincristine
  - Deep, constant pain in the maxillary molars.
  - Not odontogenic pathology
  - Will subside after treatment is complete or dose is reduced

Trismus
- Jaw soreness and limited mouth opening
- Daily oral stretching
- Aggressive treatment for severe cases
  - Periosteal aids
  - Trigger-point injections
  - Analgesics
  - Muscle relaxants

Nausea and vomiting
- Vomit has a lower pH causing erosion of the teeth
- Treatment:
  - Rinse with water and baking soda
  - Do not brush teeth immediately after vomiting.

Oral considerations after the completion of treatment
Oral Health After Treatment

- Continued oral concerns after cancer treatment
  - Periodic evaluation (every 6 months)
  - Orthodontic treatment
  - Continued oral side effects
  - Oral developmental side effects

Dental recall examination

- Cancer therapy is complete, the patient should be evaluated by a dentist for continued monitoring of the oral health
- Exam every 6 months for
  - Reinforcement of OH, diet, and fluoride application.
  - Treatment of xerostomia, xerostomia or other oral conditions may be monitored more frequently
  - Chronic oral GVHD or severe mucositis should be closely monitored
  - Malignant transformation of their oral mucosa.

Orthodontic Treatment

- Orthodontic treatment can occur after the patient has been disease free for at least two years and all therapy has been completed.

Continued oral side effects

- Xerostomia may continue after treatment is complete.
  - Continued support with reinforcement of OH and diet, application of fluoride at regular intervals.
  - Continued salivary stimulation and supplementation.
  - Trismus may continue as well
  - Daily oral stretching
  - Use of any prosthesis aids

Oral developmental side effects

- Some developmental side effects that parents should be made aware include:
  - Incomplete root development
  - Increased enamel thickness
  - Increased incidence of peg laterals
  - Delayed tooth development

References

- [Reference 1]
  - [Title of Reference]
- [Reference 2]
  - [Title of Reference]
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