

Chapter 10: Oral and Dental Health Care

Introduction

The health of the mouth and surrounding craniofacial structures is central to overall health. Thus, the goals of dental care are to prevent and control oral and craniofacial diseases, conditions, and injuries. All patients with Fanconi anemia (FA), regardless of age, should be under the care of a dentist. With a few exceptions, dental treatment is similar for FA patients and healthy individuals. This chapter provides guidance to patients with FA and their families on dental care and oral health maintenance, and educates dental practitioners about particular aspects of FA that can impact dental treatment.

Importance of Oral Hygiene

The oral cavity harbors a variety of microorganisms, also known as the oral microbiota. This community of microorganisms is predominantly composed of bacteria, though fungi and viruses can also be present. Therefore, it is not surprising that bacteria cause many common oral diseases.

Common oral and dental diseases include:

- ***Tooth decay (caries), pulp infections, and abscessed teeth.*** These are particularly important to identify and treat in patients with FA, who have defects in both innate and adaptive immunity, to prevent the spread of infection throughout the body.
- ***Gingivitis*** is a condition characterized by gums that bleed and are red and swollen, particularly in the areas at the base of the teeth and between teeth (known as dental papilla). Left untreated, gingivitis can increase the risk of periodontitis (described below).
- ***Periodontitis*** is an irreversible condition characterized by the loss of the bone and fibrous tissues that attach the teeth to the gums, the presence of periodontal pockets (deep spaces between the tooth surface and the gums), bleeding gums, and occasionally the loss of periodontal bone, which causes teeth to loosen.

It is never too early for individuals with FA to practice effective oral health care on a daily basis. A person with good oral hygiene has a much lower risk of developing oral health problems, and these problems are likely to be much less severe when they do occur. Patients with FA are susceptible to cancers of the head and neck, so it is especially important to maintain healthy oral microbiota. There is increasing evidence for the potential contribution of oral microorganisms and oral inflammation to head and neck carcinogenesis ⁽¹⁻⁵⁾. In addition, poor oral hygiene has been linked to increased risk for esophageal carcinoma ⁽⁶⁾. Furthermore, periodontitis, which is mediated by oral bacteria and inflammation, has been suggested as a possible risk factor for head and neck oral squamous cell carcinoma ⁽³⁾. Even though these associations do not imply causation, it is prudent to control the circumstances that may lead to gingivitis and periodontitis. Therefore, it is important for FA patients to aim for the best possible oral hygiene.

Oral Hygiene at Home

Toothbrushing

Dental plaque contains a thick film of bacteria that have attached themselves to the tooth's surface. Twice daily toothbrushing is the most effective method to remove plaque, thus preventing gum diseases and tooth decay. Manual and electric toothbrushes are overall equivalent in their ability to remove plaque. If an individual has physical limitations that can impact his or her physical ability to hold onto and use a toothbrush, adaptive aids may need to be constructed. Parents of young children with FA should brush the child's teeth until the child can competently care for his or her own teeth.

The frequency of toothbrushing should be increased in patients who have a high risk for caries, such as individuals with reduced salivary flow, known as xerostomia. Xerostomia can occur in patients with FA ⁽⁷⁾ and may develop as a side effect of certain medications, stress, anxiety, diabetes, dehydration, graft versus host disease (GvHD), or radiation therapy for head and neck tumors.

In the mouth, the surface of the tongue is heavily populated with microorganisms, which can contribute to halitosis and gum diseases. Thus, daily tongue cleaning using a toothbrush is also important.

Toothpastes

Patients should use a toothpaste that contains fluoride, which is the most effective agent for preventing dental decay. Many natural toothpastes do

not contain fluoride and therefore do not help to reduce the risk of caries. Some toothpastes contain the antimicrobial triclosan, which is also used in a number of skin cleaners and scrubs. An increasing number of studies suggest that triclosan may alter hormone regulation, and there are concerns about the emergence of triclosan-resistant bacteria. Although the potential detrimental effects of triclosan remain inconclusive, patients with FA are advised to avoid triclosan-containing products due to their predisposition to endocrine disorders.

Some whitening toothpastes contain abrasive agents and chemical additives, such as sodium bicarbonate or sodium pyrophosphate, to help break down and remove surface stains. Whitening toothpastes might also contain bleaching agents, such as hydrogen peroxide or carbamide peroxide, which may be a concern for patients with FA due the potential carcinogenic effects of peroxide. Therefore, whitening toothpastes are not worth the potential health effects that might be caused by exposure to hydrogen peroxide.

Plaque removal devices

Plaque that forms between teeth is virtually unreachable by toothbrushing, but should be removed at least once daily by flossing to prevent gum disease and cavities. Various plaque-removal devices are available, including floss, tape, electric interdental cleaners, and wooden sticks; the choice of device should be based on the anatomy of the teeth and the dexterity of the patient. Therefore, patients with FA who have hand and arm abnormalities may need to experiment to find a device that works well and is easy to manipulate. Other devices that can be used to remove plaque include interdental and end-tufted brushes.

Mouth rinses and topical fluoride treatments

Mouth rinses containing fluoride can be used to prevent tooth decay, rinses containing antimicrobials can prevent both tooth decay and gum disease, and both types of rinses can be used to improve breath odor. However, many mouth rinses contain alcohol, with concentrations ranging from 6%-26.9%. Some studies suggest that alcohol-containing mouth rinses are associated with cancers of the mouth and throat, whereas other studies have found no association between these mouth rinses and cancer development. ***Despite the contradictions in the research, it seems prudent to recommend that patients with FA avoid the use of mouth rinses that contain alcohol.*** Alcohol-free mouth rinses are available and appear to be as effective as their alcohol-containing counterparts.⁽⁸⁾

Mouth rinses that contain compounds to kill bacteria, including chlorhexidine (CHX) or other anti-microbials, can provide effective plaque removal in circumstances where mechanical plaque removal is not possible, such as after oral surgical procedures. In the US, mouth rinses that contain antibiotics are available by prescription only, and generally need to be mixed by a pharmacist. Mouth rinses that contain povidone iodine should not be used by patients who are allergic to iodine, children under 6 years of age, patients with thyroid disorders, or patients taking lithium.

A number of over-the-counter mouth rinses are available to help control plaque accumulation. Some products contain 0.05% cetylpyridinium chloride (CPC), a compound that kills bacteria, or phenolic essential oils, which also reduce plaque and gingivitis. However, patients should be aware that many of these formulations have an alcohol content of 20% or greater, and should be avoided. Alcohol-free formulations are available and appear to be equally as effective ⁽⁹⁾.

Topical fluoride treatments are available over-the-counter or by prescription, and are suitable for use in children as well as adults. Topical fluoride treatments can be self-applied using gels, mouth rinses, or varnishes. The application method should be selected based on the patient's ability to use the method of application.

Professional Oral Health Care

All FA patients require professional dental care. The dental health care team should include a **dentist** and a **dental hygienist** who are aware of the complexities of the oral health issues in patients with FA, and, when needed, can include other dental specialists. When appropriate, the dental health care team will work in close collaboration with the primary FA health care specialist to provide coordinated, comprehensive care.

Oral examinations

Individuals should receive routine oral and dental examinations every 6 months. Examinations can occur more frequently if changes occur in the patient's medical and dental conditions, such as the development of periodontitis, diabetes, or xerostomia. In addition, patients with FA have a 500- to 700-fold increase in the incidence of head and neck squamous cell carcinoma (HNSCC), and an increased prevalence of oral cancer. Therefore, the primary objectives of these exams include the prevention and early

detection of oral diseases such as dental caries, gingivitis, periodontitis, and oral cancer.

During an exam, the dentist evaluates the inside of the mouth as well as the soft tissues of the head and neck; any unusual findings should be further investigated. Caries can be detected by the clinical and radiographic examination of tooth surfaces and restorations. Changes in the color, consistency, and contour of the gums can reveal the development of gingivitis and periodontitis. Furthermore, gingival inflammation and plaque accumulation are involved in the development of periodontal diseases, which has been associated with an increased risk of head and neck cancer. Thus, visits to the dentist also allow the dental team to evaluate the patient's oral hygiene practices and reinforce self-performed plaque control.

- **Radiographs**

Many oral diseases cannot be detected with a visual or physical exam. Dental x-rays can help the dentist find cavities between teeth or under fillings, diagnose gum and bone diseases and some types of tumors, and better plan surgical interventions. These images can help detect and treat these hidden problems at an early stage, before more extensive treatment is necessary (for more information, please see: www.ADA.org). Radiographs and other imaging modalities are used to diagnose and monitor oral diseases, as well as to monitor dentofacial development and the progress or prognosis of therapy. However, x-rays should only be taken when there is an expectation that the additional information they can provide might result in improved patient care. Thus, the dentist must weigh the benefits of a radiographic examination against the risk of exposing a patient to x-rays, the effects of which accumulate from multiple sources over time. Based on the patient's health history and vulnerability to oral disease, the dentist may make this assessment in the interest of each patient.

In 2012, the American Dental Association and the FDA devised recommendations for the selection of patients for dental radiographic examinations (please see: <http://www.ada.org/en/member-center/oral-health-topics/x-raysguidelines>), which can serve as a framework for dentists who treat patients with FA. According to this document, the dentist is advised to conduct a clinical examination, consider the patient's signs, symptoms, and oral and medical histories, as well as consider the patient's age and vulnerability to environmental factors that may affect oral health.

This diagnostic and evaluative information may determine the type of imaging to be used or the frequency of its use.

Once the need for radiographs is determined, a conscious effort should be made by the dentist to reduce the radiation risks of dental x-rays, including limiting the number of radiographs, using protective gear (e.g., leaded aprons and thyroid collars), and using faster speed films and digital imaging.

Good to Know

Radiation exposure

When taken properly, dental radiographs provide limited exposure to x-rays. In fact, natural sources of radiation can provide more radiation exposure than dental x-rays. For instance, a panoramic dental x-ray exam may expose a patient to only about 1 millirem (a unit of absorbed radiation dose), whereas a cross-country flight exposes an individual to 5 millirem of cosmic radiation. Moreover, the National Council on Radiation Protection (NCRP) estimates that the average resident of the US receives about 360 millirem of radiation every year. Exposure can be minimized even further with the use of digital radiographs. Additional references for comparison are listed in the table below, and more information on this topic can be found in Linet, 2012 ⁽¹⁵⁾.

Effective radiation doses from various dental x-ray procedures.

	μSv	mSv	mrem
Panoramic	6–11	0.006-0.011	0.6-1.1
Cephalometric	6–11	0.006-0.011	0.6-1.1
TMJ tomogram	2	0.002	0.2
Full-mouth intraoral	10–15	0.01-0.015	1-1.5
Bitewings (4 x-rays)	2–3	0.002-0.003	0.2-0.3
Mandible CT	150–700	0.15-0.7	15-70
PA and lat. chest x-ray (for comparison)	170	0.17	17
Background radiation per year (for comparison)	3,600	3.6	360

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Source: <http://hps.org/publicinformation/ate/faqs/dentalpatientissuesq&a.html>

- **Detecting oral and head and neck cancers**

Head and neck cancers, which include cancers of the oral cavity, are of particular concern for patients with FA. As the health care provider who is most familiar with a patient's oral cavity, the dentist is in the unique position to identify subtle changes or lesions in an early stage. Screening for oral and head and neck cancers should begin by age 9-10 years in patients with FA. Screening should be performed every 6 months by an experienced professional, complying with the World Health Organization (WHO) oral cancer examination method as follows:

- Inspect the face, head, ears, and neck, noting any asymmetry or changes on the skin; palpate the lymph node areas on both sides of the head and neck to detect any enlarged nodes.
- Observe the lips with the mouth both closed and open, noting color, texture, and any surface abnormalities.
- Examine the labial mucosa (the inside lining of the lips), noting color, texture, and any swelling or other abnormalities.
- Examine the right and left buccal mucosa (the inside lining of the cheeks).
- Examine the tonsillar region, noting any change in pigmentation, color, texture, mobility, and other abnormalities.
- Examine the upper and lower gingival and alveolar ridges (which contain the sockets of the teeth), including the parts facing the cheeks and lips and the parts facing the tongue.

- With tongue at rest and mouth partially open, examine the dorsum for swelling, ulceration, coating, or variation in size, color, or texture. Note any change in pattern of papillae covering on tongue surface and examine the tip of tongue. Note any abnormality of mobility or positioning of the protruded tongue. Using mouth mirrors, inspect right and left sides of tongue. Grasp the tip of tongue and examine the surfaces of the tongue that face the floor of the mouth. Palpate the tongue to detect growths.
- With the tongue elevated, inspect the floor of mouth for changes in color, texture, swelling, or other surface abnormalities.
- Inspect the hard and soft palate with mouth wide open, head back, and tongue depressed. Examine all soft palate and oropharyngeal tissues. Palpate the floor of mouth for any abnormalities. Palpate all mucosal or facial tissues that appear abnormal.

Cancer Screening Tools

Two non-invasive tests, **toluidine blue vital staining** and **exfoliative cytology techniques**, are FDA-approved and can help identify malignant cells and serve as a guide for biopsy. These tests are not diagnostic, however. Biopsy remains the only proven way to diagnose cancer.

Chemiluminescence and **tissue autofluorescence** can be used to screen for oral pre-malignant and malignant lesions. These techniques only serve to guide or illuminate where a biopsy may be needed. Again, biopsy is the only proven way to diagnose cancer.

- **Chemiluminescence** involves rinsing the mouth with a 1% acetic acid solution and then examining mucosa with a special light (wavelength 490-510 nm); it has been proposed that abnormal mucosa will reflect a white color and normal mucosa will appear blue.
- **Autofluorescence** techniques illuminate oral tissues with a special blue light (400-460 nm). Abnormal (potentially malignant) tissue exhibits a decreased ability to autofluorescence and appears darker when examined.

If an individual with FA is not already under the care of an ear, nose, and throat specialist (ENT), the dentist should refer the patient to an ENT for a flexible fiber optic exam of the nasopharynx, oropharynx, hypopharynx, and larynx, especially if the patient develops any persistent symptoms such as odynophagia (severe pain on swallowing), dysphagia (difficulty swallowing), and/or voice changes (see *Chapter 14*).

Restorative treatments

- **Fillings and restorative materials**

Dental fillings can be used to restore function to teeth that have become damaged or decayed. There are several dental filling materials available. Amalgam fillings, which are made of mercury, silver, tin, copper, and other trace metals, have been used extensively for many decades. Amalgam fillings are easy to place, strong, and have good longevity. However, it remains unclear whether the mercury in amalgam fillings is harmful to health ⁽¹⁰⁾. Therefore, the use of amalgam fillings in patients with FA should be limited until further research is available.

Tooth-colored, synthetic resins known as composite resins can be used as a restorative material or adhesive. Composite resins are approved for use in all teeth and can replace the use of amalgam in molar teeth. However, patients should be warned that composite fillings are associated with an increased occurrence of secondary decay and tooth sensitivity. Composite resins may be of potential concern for patients with FA due to the presence of bisphenol A (BPA), which may have endocrine-disrupting, estrogenic properties. However, the potential harmful effects of BPA remain controversial and no unacceptable risks for the patient have yet been recognized ⁽¹¹⁾. Furthermore, BPA exposure can be reduced by cleaning and rinsing surfaces of sealants and composites immediately after placement ⁽¹²⁾.

The best way to avoid the need for those restorative materials is to decrease the patients' risk for caries. This can be achieved by aiming for optimal oral hygiene, following a balanced diet (low in sucrose), and having access to fluoride as appropriate.

- **Orthodontic treatment**

The use of braces to reposition the teeth should not pose a problem for patients with FA who are not neutropenic or otherwise immunocompromised. However, the brackets and wires on the braces can cause trauma and chronic inflammation in some patients. Because chronic physical irritation has been reported to be associated with oral cancer in clinical studies ^(13, 14), efforts should be made to prevent them in patients with FA. Recently, new orthodontic treatment methods such as Invisalign® have been developed that obviate the need for traditional braces in certain cases.

- **Dental implants**

Dental implants are titanium cylinders that are implanted into the jaw bone to replace missing teeth. They act as artificial roots to hold crowns or dentures in place. It should be noted that FA is not a contraindication for dental implants. A patient with FA should be stable (i.e., non-immunocompromised and non-thrombocytopenic) and meet all the normal requirements for implants, such as sufficient bone volume and the ability to maintain good hygiene.

- **Oral surgery**

Oral and maxillofacial surgeons are involved in the diagnosis and management of diseases, injuries, and defects of the oral and maxillofacial region. Common reasons to visit the oral surgeon include tooth removal (including removal of the third molars or “wisdom” teeth), treatment of dental infections, biopsy of oral lesions, or reconstruction with dental implants. Patients may also need to see an oral surgeon for the treatment of trauma to the oral region or facial bones. The majority of procedures can be safely and comfortably done in the oral surgeon’s office, where sedation is often used. The sedation techniques used in an oral surgery office are very similar to those used during an FA patient bone marrow aspirate or biopsy. Patients with FA who are non-immunocompromised and non-thrombocytopenic can usually be treated in a routine fashion. The oral surgeon may need to consult with the patient’s hematologist about any questions or concerns.

Developmental and Mucosal Changes Associated with FA

A number of oral and dental changes have been reported in patients with FA. Many of these changes also occur in healthy children, so it remains unclear whether they are associated with FA itself or rather with treatments for oral and head and neck cancers and marrow disorders, such as high-dose chemotherapy and hematopoietic stem cell transplantation (HSCT), which are known to adversely affect the development of teeth and jaws in children younger than 12 years. Regardless, it is important to recognize, diagnose, and manage these changes because they can complicate oral health and function.

Dental and skeletal developmental changes that have been reported in patients with FA include:

- *Microdontia (teeth that are smaller than normal)*
- *Supernumerary teeth (extra teeth)*
- *Agenesis (teeth that do not develop normally)*
- *Changes in the color of the tooth enamel (e.g., abnormally dark or discolored teeth, or opalescent enamel)*
- *Abnormal tooth shape, rotation, and position of teeth within the mouth*
- *Delayed development of teeth (usually permanent teeth), including delayed loss of primary (baby) teeth and eruption of permanent teeth compared with healthy peers*
- *Micrognathia (underdeveloped jaws)*

Oral changes that have been reported in patients with FA include:

- *Gingivitis (inflammation of the gums) and periodontitis (gum disease)*
- *Macroglossia (an unusually large tongue)*
- *Bleeding abnormalities, including bleeding gums and lesions caused by trauma*
- *Abnormal pigmentation of the tongue, cheek mucosa, floor of the mouth, and gums*
- *Dental caries (tooth decay)*
- *Salivary gland dysfunction, resulting in altered flow or composition of the saliva, which may increase the risks for dental decay and oral infections*
- *Oral ulcers*
- *Oral cancer and head and neck cancers*

Oral ulcers occur frequently in patients with FA and can cause anxiety due to the high risk of oral cancer in these individuals. Oral ulcers or any oral lesions that do not resolve within 10 days need to be assessed by a health care professional. The most serious oral lesion associated with FA is oral cancer, most commonly squamous cell carcinomas (SCCs), which will be discussed in detail in *Chapter 14*.

Assessing oral ulcers in patients with FA

It is extremely important for clinicians to differentiate between canker sores, ulcerations caused by a condition known as aphthous stomatitis, and oral ulcerations due to other potential causes.

- A **canker sore** is a lesion that often develops after a relatively mild trauma and heals within approximately 4-7 days.
- **Aphthous stomatitis** is characterized by multiple ulcers that occur simultaneously and can recur as often as once a month (just as the previous ulcers are healing). Most cases of aphthous stomatitis can be treated with topical steroids applied directly to the ulcer (Table 1).
- Patients who have **neutropenia** (a low neutrophil count) can develop oral ulcers that are clinically indistinguishable from canker sores. Such neutropenic ulcers can develop spontaneously or after a mild trauma (such as a mild bite injury), but tend to worsen and become painful. Neutropenic ulcers can be an early indication of bone marrow diseases, such as aplastic anemia or leukemia, though additional systemic signs and symptoms of bone marrow disease will often be present. Additionally, cancer therapies such as chemotherapy can cause severe neutropenia and neutropenic ulcerations.
- Recurrent **herpes simplex virus (HSV) infections** can cause ulcerations of the oral mucosa and lip. These lesions are often associated with the immune dysfunction that often accompanies severe AA, MDS, and AML. They can also arise after high-dose chemotherapy or HSCT.

Table 1. Management of recurrent aphthous ulcerations.

Treatment	Dose and Treatment Schedule
Topical anesthetics	<ul style="list-style-type: none"> • 2% viscous lidocaine • Doxepin solution
Topical coating agents	<ul style="list-style-type: none"> • Hydroxypropylcellulose film (Zilactin®)
Topical corticosteroids	<ul style="list-style-type: none"> • 0.05% clobetasol gel • 0.05% flucinonide gel • mg/ml dexamethasone elixir • Budesonide inhaler
Intralesional injection	<ul style="list-style-type: none"> • 40 mg/ml triamcinolone (0.1 - 0.3 ml)
Systemic therapy	<ul style="list-style-type: none"> • 0.5 - 1 mg/kg prednisone • Thalidomide

Table 2. Oral health problems in patients with bone marrow dysfunction.

Oral Health Problem	Cause(s)	Management
Bleeding	<ul style="list-style-type: none"> • Thrombocytopenia (loss of platelets) 	<ul style="list-style-type: none"> • Avoid oral trauma • Prevent infection
Bacterial infections	<ul style="list-style-type: none"> • Loss of white blood cells, especially neutrophils • Secondary infection of traumatic oral lesions 	<ul style="list-style-type: none"> • Maintain excellent oral hygiene • Antibacterial mouthwashes • Systemic antibiotics for severe infections
Fungal infections (primarily yeast)	<ul style="list-style-type: none"> • Loss of white blood cells, especially neutrophils • Loss of salivary gland function • Use of systemic antibiotics 	<ul style="list-style-type: none"> • Topical antifungals (nystatin or clotrimazole) for oral yeast infections • Systemic antifungals for extensive infections
Viral infections (primarily herpes simplex virus (HSV), but also varicella zoster virus (VZV), cytomegalovirus (CMV), or Coxsackie group viruses)	<ul style="list-style-type: none"> • Immune dysfunction, including neutropenia 	<ul style="list-style-type: none"> • Systemic antiviral drugs (acyclovir or valacyclovir)
Delayed healing of oral tissues	<ul style="list-style-type: none"> • Loss of white blood cells (especially neutrophils), resulting in secondary infections • Severe anemia 	<ul style="list-style-type: none"> • Obtain primary closure of extraction or surgical sites • Reduce risk for trauma and irritation • Prevent secondary infection
Gum enlargement, bleeding, and pain	<ul style="list-style-type: none"> • Accumulation of leukemic cells in gum tissue, usually in response to gingivitis • Medication-induced gum enlargement 	<ul style="list-style-type: none"> • Maintain excellent oral hygiene • Treat the leukemic disease • Consider medication modification
Facial and oral neuropathies (nerve damage)	<ul style="list-style-type: none"> • Compression of nerve bundles by leukemic cells, resulting in numbness and tingling 	<ul style="list-style-type: none"> • Treat the leukemic disease

Oral Care Before and After Treatment for Bone Marrow Dysfunction and Cancer

The treatment and management of oral cancers and marrow dysfunction can result in a wide spectrum of oral complications for patients with FA. Preventing and controlling oral complications can improve the patient's quality of life, and, in many instances, potentially improve the outcomes of the patient's treatments.

Prior to treatment for oral cancer or bone marrow dysfunction, patients should undergo a complete oral examination and dental evaluation. Dental care should focus on eliminating any oral and dental diseases that could contribute to oral complications during treatment. Teeth with a poor long-term prognosis due to periodontal disease and/or teeth deemed to be non-restorable should be extracted. In situations where extractions are not possible due to the patient's medical status, time-release antibiotics can be placed in deep periodontal pockets to reduce the levels of bacteria in the region for several weeks and thus hopefully reduce the risk of periodontal infections.

Prior to radiation therapy, the dentist should review the details of the proposed radiation therapy plan, paying particular attention to the following:

- *The teeth that are included within the fields of radiation treatment*
- *The total dose of radiation that these teeth (and their surrounding bone) will receive*
- *The salivary glands that will be in the radiation fields and the total dose of radiation that these salivary glands will receive*

Patients must be informed of the potential oral complications of cancer surgery, head and neck radiation therapy, chemotherapy, and hematopoietic stem cell transplantation, including the causes, prevention, and management of the complications. Patients must accept responsibility for maintaining the highest level of oral hygiene and adhering to protocols to reduce the risk of oral complications of treatments for oral cancer and bone marrow dysfunction.

Routine oral care after HSCT is essential to help maintain oral health and prevent infections and bleeding problems associated with gingivitis and periodontal disease. Once dental examinations resume after HSCT, the dentist should carefully examine the patient's teeth and periodontal tissues, and x-ray images should be obtained if pre-transplant images are not available. However, routine elective dental treatment, including dental cleanings and restorations, should wait until the patient's immune system has sufficiently recovered.

If a patient urgently needs dental treatment before the immune system has recovered, the dentist and physician should determine what additional supportive medical care should be given. Supportive care may include prophylactic antibiotics, immunoglobulin G administration, adjustment of steroid doses, and platelet transfusions if the patient has a significant risk for bleeding. Rinsing with chlorhexidine immediately before treatment is

recommended. Prophylactic antibiotic regimens (American Heart Association endocarditis prevention protocols) appear to be efficacious, with regimens being extended if there is ongoing dental infection or if there is concern for delayed healing. Dentists should also utilize techniques such as rubber dams and high-volume suction devices, and minimize the spraying of dental equipment to reduce the chances that the patient will inhale any dangerous substances during dental treatment. The dental care team should also aim to reduce the complexity of treatments and shorten treatment times.

Chapter Committee

David K. Fiaschetti, DDS, Mark M. Schubert, DDS, MSD, and Flavia R. Teles, DDS, MS, DMSc#*

**Committee chair*

#Consensus conference presenter

References

1. Meurman JH, Uittamo J (2008) Oral micro-organisms in the etiology of cancer. *Acta Odont Scan* 66(6):321-326.
2. Hooper SJ, Wilson MJ, Crean SJ (2009) Exploring the link between microorganisms and oral cancer: a systematic review of the literature. *Head and Neck* 31(9):1228-1239.
3. Tezal M, *et al.* (2009) Chronic periodontitis and the incidence of head and neck squamous cell carcinoma. *Can Epidem Biomarker Prev* 18(9):2406-2412.
4. Meurman JH (2010) Oral microbiota and cancer. *J Oral Microbiol* 2: 10.3402/jom.v2i0.5195.
5. Bebek G, *et al.* (2012) Microbiomic subprofiles and MDR1 promoter methylation in head and neck squamous cell carcinoma. *Hum Mol Genet* 21(7):1557-1565.
6. Abnet CC, *et al.* (2008) Tooth loss and lack of regular oral hygiene are associated with higher risk of esophageal squamous cell carcinoma. *Cancer Epidemiol Biomarkers Prev* 17(11):3062-3068.
7. Mattioli TM, *et al.* (2010) Salivary flow rate, calcium, urea, total protein, and amylase levels in Fanconi anemia. *J Ped Hematol Oncol* 32(2):e46-49.

8. Werner CW, Seymour RA (2009) Are alcohol containing mouthwashes safe? *Br Dent J* 207(10):E19; Discussion 488-489.
9. Cortelli SC, Cortelli JR, Shang H, McGuire JA, Charles CA (2013) Long-term management of plaque and gingivitis using an alcohol-free essential oil containing mouthrinse: a 6-month randomized clinical trial. *Am J Dent* 26(3):149-155.
10. Crespo-Lopez ME, *et al.* (2009) Mercury and human genotoxicity: critical considerations and possible molecular mechanisms. *Pharmacol Res* 60(4):212-220.
11. Schmalz G (1998) The biocompatibility of non-amalgam dental filling materials. *Eur J Oral Sci* 106(2 Pt 2):696-706.
12. Fleisch AF, Sheffield PE, Chinn C, Edelstein BL, Landrigan PJ (2010) Bisphenol A and related compounds in dental materials. *Pediatrics* 126(4):760-768.
13. Vaccarezza GF, Antunes JL, Michaluart-Junior P (2010) Recurrent sores by ill-fitting dentures and intra-oral squamous cell carcinoma in smokers. *J Public Health Dent* 70(1):52-57.
14. Piemonte ED, Lazos JP, Brunotto M (2010) Relationship between chronic trauma of the oral mucosa, oral potentially malignant disorders and oral cancer. *J Oral Pathol Med* 39(7):513-517.
15. Linet MS (2012) Cancer risks associated with external radiation from diagnostic imaging procedures. *CA: Cancer J Clin* 62(2):75-100