Clinical guideline on dental management of pediatric patients receiving chemotherapy, hematopoietic cell bone marrow transplantation, and/or radiation

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Purpose
The pediatric patient who is beginning, currently is receiving, or has received chemotherapy, a bone marrow transplant (BMT), and/or radiation requires special consideration and altered oral/dental treatment schemes due to the systemic impact of any of these cancer treatments. The American Academy of Pediatric Dentistry recognizes that the dental professional plays an important role in the diagnosis, prevention, stabilization, and treatment of oral and dental problems that can compromise the child's quality of life before, during, and after the cancer treatment. Dental intervention with certain modifications must be done promptly and efficiently, with attention to the patient's medical history, treatment protocol, and health status.

Pediatric patients undergoing chemotherapy and/or radiotherapy for the treatment of cancer or in preparation for hematopoietic cell transplantation (HCT) may present many acute and long-term side effects in the oral cavity. Furthermore, because of the immunosuppression they experience, any existing or potential oral/dental infections and trauma can compromise the medical treatment, leading to morbidity, mortality, and higher hospitalization costs. It is also imperative that the dentist be familiar with the oral manifestations of the patient's underlying condition and the treatment differences between patients undergoing chemotherapy only and those who will receive an HCT.

Methods
This guideline is based on a review of the current dental and medical literature related to on dental management of pediatric patients receiving chemotherapy, hematopoietic cell transplantation, and/or radiation. A MEDLINE search was conducted using the terms “pediatric cancer”, “pediatric oncology”, “hematopoietic cell transplantation”, “bone marrow transplantation”, “mucositis”, “stomatitis”, “chemotherapy”, “radiation therapy”, “acute effects”, “long-term effects”, “dental care”, “pediatric dentistry”, and “clinical practice guidelines”. Expert opinions and best current practices were relied upon when sufficient scientific data were not available.
Background/Literature Review

The level of a child’s oral health can be a significant determinant in the outcomes of any of these cancer treatments. A child who is immunosuppressed is at high risk for septicemia due to oral infections. The eradication of active and potential sites of infection prior to initiation of chemotherapy, bone marrow transplantation and/or radiation is paramount. Therefore, it is highly recommended that an oral/dental examination and treatment be a part of the precancer treatment protocols at all institutions providing those type of services.

These guidelines are general recommendations for the management of the pediatric cancer patient. Since there are a myriad of protocols for chemotherapy, BMT and radiation, oral/dental care must be provided in consultation with the oncologist and, if necessary, tailored to the individual patient. There are few “absolute” guidelines in the care of these patients, but the literature supports the following.

The most frequently documented source of sepsis in the immunosuppressed cancer patient is the mouth; therefore, early and radical dental intervention, including aggressive oral hygiene measures, reduces the risk for oral and associated systemic complications. In a consensus conference on oral complications of cancer therapies sponsored by the National Institutes of Health in 1989, the most important recommendations were that all patients with cancer should have an oral examination before initiation of the oncology therapy, and that treatment of pre-existing or concomitant oral disease was essential to minimize oral complications in this population. The underlying success in maintaining a healthy oral cavity during cancer therapy is patient compliance. Thus, the child and the caretakers should be educated regarding the possible acute side effects and the long-term sequelae in the oral cavity.

Younger patients present more oral problems than adults. Because there are many oncology and HCT protocols, every patient should be dealt with on an individual basis and appropriate consultations with physicians and other dental specialists should be sought before dental care is instituted.

Recommendations

Hematologic guidelines

The following are general hematologic guidelines. Specific guidelines should be established between the pediatric dentist and oncology service.

1. Elective dental procedures:
   a. Absolute neutrophil count (ANC) >1,000/mm³.
   b. Platelet count >40,000/mm³.

2. Emergency dental procedures: May be performed with any hematologic status to remove sources of infection if done in coordination with the oncology service. Consider platelet replacement if the platelet count is <40,000/mm³.

3. Preventive dental procedures:
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Antibiotic prophylaxis guidelines

Refer to Guideline on Antibiotic Prophylaxis for Patients at Risk (see pages 107-108). The following are general antibiotic prophylaxis indications:

1. Patient has an ANC <500/mm³ and/or white blood cell count (WBC) <2,000/mm³.
2. Patient has a central venous catheter.
3. Patient is taking long-term immunosuppressive drugs (e.g., cyclosporine, prednisone).

Management

Objectives

1. Decrease the morbidity and mortality due to infection.
2. Decrease the morbidity due to hemorrhage.
3. Facilitate the patient’s nutritional status.
4. Improve the patient’s comfort.
5. Increase the education of the patient, family and physician relative to the importance of maintaining oral health and the methods to achieve it.

Management of the pediatric cancer patient can be divided into 3 phases of care. Although the overall management of these patients is a continuum of assessment and treatment decisions, they can be roughly divided into phases based on time and hematological status. Each presents unique potential oral problems and opportunities for treatment.

Phase 1: The period of time from the medical diagnosis/admission to the initiation of chemotherapy/radiation. The child has active disease and hematological changes related to the disease.

Phase 2: A period lasting approximately 30 to 45 days after chemotherapy induction, bone marrow transplantation and/or radiation. This period represents the most intense therapy. Significant myelosuppression and immunosuppression is the result of chemotherapy/radiation.

Phase 3: Post-chemotherapy, BMT and/or radiation, the long term follow-up for which may last anywhere from a year to a lifetime.
Phase I

Assessment and diagnosis

Ideally, the oral assessment of the pediatric patient should occur 7 to 10 days prior to the initiation of chemotherapy/radiation. Oftentimes, however, this is not possible due to the medical status of the child and treatment options may be limited. Every effort should be made to educate the oncology service as to the importance of early intervention and to encourage them to make the dental referral as early as possible.

1. Review the child’s health history, particularly as related to the child’s current disease.
2. Review current blood data with particular attention to WBC, differential, ANC and platelet count.
4. Complete a thorough head, neck, oral and dental examination.
5. Make panoramic and bitewing radiographs as basic screening films. Additional radiographs should be based on clinical findings.
6. Give standard oral hygiene instructions, with emphasis on instructions specifically related to chemotherapy and/or radiation.
7. Formulate a treatment plan in coordination with patient, family and oncologist.

Treatment

Treatment should only be provided in consultation with the oncologist and after careful review of blood lab data (see hematologic guidelines on previous page). Consideration must be given to antibiotic prophylaxis.

1. Complete a dental scaling and polishing.
2. Apply a fluoride gel in the standard manner.
3. Restore carious teeth and replace defective restorations.
4. Institute pulp therapy as indicated. Pulpotomy and pulpectomy are preferable to extraction if no breakdown of periradicular supporting tissues is present.
5. Extract teeth with acute or chronic infections and breakdown of periradicular supporting tissues. Ideally, all extractions should be done 5 to 7 days prior to the initiation of chemotherapy/radiation.
6. Manage soft tissue lesions related to disease conservatively and symptomatically.
7. Remove all orthodontic appliances and removable prostheses.
8. Initiate an antimicrobial rinse (eg, chlorhexidine) 2 to 3 times per day beginning 2 days prior to the start of chemotherapy/radiation.


**Dental and Oral Care Before the Initiation of Cancer Therapy**

**Objectives:** The objectives of a dental/oral examination before cancer therapy starts are two-fold:

1. to identify and stabilize or eliminate existing and potential sources of infection, local irritants, and irregular surfaces that may complicate the cancer therapy and HCT without needlessly delaying the cancer treatment or inducing complications; and
2. to educate the patient and caretakers about the importance of optimal oral care in order to minimize oral problems/discomfort during and after treatment and about the possible acute and long-term effects of the therapy in the craniofacial complex.

**Initial evaluation**

**Medical history review** should include, but not be limited to, type of cancer, treatment protocol, medications, allergies, and immunosuppression status. For HCT patients, include type of transplant, conditioning protocol, and Graft versus Host Disease (GVHD) prophylaxis. The presence of an indwelling venous catheter (ie central line) dictates the need for endocarditis prophylaxis following the American Heart Association (AHA) recommendations; however, this recommendation is empirical.5,10

**Dental history review** includes information such as habits, trauma, symptomatic teeth, previous care, preventive practices, etc.

**Oral/dental assessment** should include thorough head, neck, and intraoral examinations, oral hygiene assessment and training, and radiographic evaluation based on history and clinical findings.

**Preventive strategies**

**Oral hygiene** includes brushing of the teeth and tongue 2 to 3 times daily with regular soft brush or electric toothbrush, regardless of the hematological status.4,5,8,9,13,17 Ultrasonic brushes and dental floss should be allowed only if the patient is properly trained.1,8 Patients with poor oral hygiene and/or periodontal disease can use chlorhexidine rinses daily until the tissue health improves or mucositis starts. The high alcohol content can cause discomfort and dehydrate the tissues.

**Diet:** Dental practitioners should encourage a non-cariogenic diet and advise caretakers about the high cariogenic potential of dietary supplements rich in carbohydrate and oral pediatric medications rich in sucrose.

**Fluoride:** Preventive measures include the use of fluoridated toothpaste, fluoride supplements if indicated, neutral fluoride gels/rinses, or applications of fluoride varnish for patients at risk for caries and/or xerostomia. A brush-on technique is the most convenient technique making patients more compliant.8

**Trismus prevention/treatment:** Patients who receive radiation therapy to the masticatory muscles may develop trismus. Thus, daily stretching oral exercises/physical therapy should start before radiation is initiated and continue throughout treatment. Therapy also may include prosthetic aids to reduce the severity of fibrosis, trigger-point injections, analgesics, muscle-relaxants, and other pain management strategies.3,5,10
Reduction of radiation to healthy oral tissues: In cases of radiation to the head and neck, the use of lead-lined stents, prostheses, and shields, as well as beam-sparing procedures, should be discussed with the radiation oncologist.

Education: Patient/caretaker education includes the importance of optimal oral care in order to minimize oral problems/discomfort during and after treatment and the possible acute and long-term effects of the therapy in the craniofacial complex.

Dental care

Hematological considerations:

1. Absolute neutrophil count (ANC)
   - >1,000/mm³: no need for antibiotic prophylaxis. However, some authors suggest that antibiotic coverage (AHA recommendations) may be prescribed when the ANC is between 1,000 and 2,000/mm³. If infection is present or unclear, more aggressive antibiotic therapy may be indicated and should be discussed with the medical team.
   - < 1,000/mm³: defer elective dental care until the ANC rises. In dental emergency cases, discuss antibiotic coverage beyond endocarditis prophylaxis with medical team before proceeding with treatment. The patient may need hospitalization for dental management.

2. Platelet count
   - >75,000/mm³: no additional support needed but be prepared to treat prolonged bleeding by using sutures, hemostatic agents, pressure packs, gelatin foams, etc.
   - 40,000 - 75,000/mm³: platelet transfusions may be considered pre- and 24 hours post-operatively.
   - < 40,000/mm³: defer care. In dental emergency cases, contact physician before proceeding. Consider platelet transfusion and hospital admission for treatment.

3. Other coagulation tests may be in order for individual patients.

Dental procedures

1. In general terms, most oncology/hematology protocols (exclusive of HCT, which will be discussed later) are divided into phases (cycles) of chemotherapy, in addition to other therapies (radiotherapy, surgery, etc). The patient’s blood counts normally start falling 5 to 7 days after the beginning of each cycle, staying low for approximately 14-21 days, before rising again to normal levels for a few days until the next cycle begins. Ideally, all dental care should be completed before cancer therapy starts. But, when that is not feasible, temporary restorations can be placed and non-acute dental treatment can be delayed until the patient’s hematological status is stable, usually in the few days between treatment cycles.

2. Prioritizing procedures: When all dental needs cannot be treated before cancer therapy is initiated, priorities should be infections, extractions, periodontal care (scaling, prophylaxis), and sources of tissue irritation before the treatment of carious teeth, root canal therapy for permanent teeth, and replacement of faulty restorations. The risk for pulpal infection and pain determine which carious lesions
should be treated first. Incipient to small caries can be treated with fluorides and sealants until definitive care can be accomplished. It is also important to be aware that the signs and symptoms of periodontal disease can be decreased in immunosuppressed patients.

3. Pulp therapy in primary teeth: Although there have been no studies to date that address the safety of performing pulp therapy in primary teeth prior to the initiation of chemotherapy and/or radiotherapy, many clinicians choose to provide a more radical treatment in the form of extraction because pulpal/periapical/furcal infections during immunosuppression periods can have a significant impact on cancer treatment and become life-threatening. Teeth that already have been treated pulpally and are clinically and radiographically sound present minimal risk.

4. Endodontic treatment in permanent teeth: Symptomatic non-vital permanent teeth should receive root canal treatment at least 1 week before initiation of cancer therapy to allow sufficient time to assess treatment success before the chemotherapy. If that is not possible, extraction is indicated. Extraction is also the treatment of choice for teeth that cannot be treated by definitive endodontic treatment in a single visit. In that case, the extraction should be followed by antibiotic therapy (penicillin or clindamycin for penicillin-allergic patients) for about 1 week. Asymptomatic endodontic needs in permanent teeth can be delayed until the hematological status of the patient is stable. It is important that the etiology of periapical lesions associated with previously endodontically treated teeth be determined because they can be caused by a number of factors including pulpal infections, inflammatory reactions, apical scars, cysts, and malignant lesions. If a periapical lesion is associated with an endodontically treated tooth and no signs or symptoms of infection are present, there is no need for retreatment or extraction since the radiolucency is likely due to an apical scar.

5. Orthodontic appliances and space maintainers: Appliances should be removed if the patient has poor oral hygiene and/or the treatment protocol or HCT conditioning regimen carries a risk for the development of moderate to severe mucositis, except for smooth appliances such as band and loops and fixed lower lingual arches. Removable appliances and retainers that fit well may be worn as long as tolerated by the patient who shows good oral care. If band removal is not possible, vinyl mouth guards or orthodontic wax should be used to decrease tissue trauma.

6. Periodontal considerations: Partially erupted molars can become a source of infection because of pericoronitis. The overlying gingival tissue should be excised if the dentist believes it is a potential risk and if the hematological status permits.

7. Extractions: There are no clear recommendations for the use of prophylactic antibiotics for extractions. Recommendations generally have been empiric or based on anecdotal experience. Particular attention should be given to extraction of permanent teeth in patients who will receive or have received radiation to the face because of the risk of osteoradionecrosis. Surgical procedures must be as atraumatic as possible, with no sharp bony edges remaining and satisfactory closure of the wounds. If there is documented infection associated with the tooth, antibiotics, ideally chosen with the benefit of sensitivity testing, should be administered for about 1 week.
• Loose primary teeth should be left to exfoliate naturally and the patient should be counseled to not play with them in order to avoid bacteremia. If the patient cannot comply with this recommendation, the teeth should be removed if the hematologic parameters allow.

• Impacted teeth, root tips, teeth with periodontal pockets ≥6 mm, teeth exhibiting acute infections, significant bone loss, involvement of the furcation, or mobility, and non-restorable teeth should be removed ideally 2 weeks (or at least 7 to 10 days) before cancer therapy starts to allow adequate healing.1,5,8,10,11

• Some practitioners prefer to extract all third molars that are not fully erupted, particularly prior to HCT, while others favor a more conservative approach, recommending extraction of third molars at risk for pulpal infection or those associated with significant periodontal infection, including pericoronitis.9

• If a permanent tooth cannot be extracted for medical reasons (i.e., severe thrombocytopenia), then the crown should be amputated above the gingiva and root canal therapy should be initiated on the remaining root fragment to minimize the risk of disseminating infection through the systemic circulation. The root canal chamber should be sealed with an antimicrobial medicament.5 Antibiotics should follow for 7 to 10 days afterwards with the extraction subsequently done when the patient’s hematological status is normal.5

Phase II

Assessment and diagnosis

1. Patients should be followed and regularly assessed for the development of oral lesions secondary to the chemotherapy/radiation.

2. Monitor mouth care and consult with nursing staff, if necessary.

3. Keep the oncologist apprised of any oral problems.

Treatment

1. Elective oral/dental treatment should be avoided.

2. Biopsy or dental treatment for eradication of sites of infection should only be done with the approval of the oncologist.

3. Continue antimicrobial rinses (2 to 3 times per day).

4. In head and neck radiation cases, provide appropriate fluoride application.

5. Provide symptomatic care for mucositis and stomatitis as needed.

Dental and Oral Care During Immunosuppression Periods

Objectives: The objectives of a dental/oral care during cancer therapy starts are threefold:

1. to maintain optimal oral health during cancer therapy;
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Preventive strategies

Oral hygiene: Intensive oral care is of paramount importance because it reduces the risk of developing moderate/severe mucositis without causing an increase in septicemia and infections in the oral cavity.1-12 Thrombocytopenia should not be the sole determinant of oral hygiene as patients are able to brush without bleeding at widely different levels of platelet count.8,9,13 Patients should use a soft nylon brush 2 to 3 times daily.8 Fluoridated toothpaste can be used but, if the patient does not tolerate it during periods of mucositis, it can be discontinued and water or saline solution can be substituted. If moderate to severe mucositis develops and the patient cannot tolerate a regular toothbrush or an end-tufted brush, foam brushes or super soft brushes soaked in aqueous chlorhexidine can be used, although they do not provide efficient cleaning.9,17 The use of a regular brush should be resumed as soon as the mucositis improves.8 Brushes should be air-dried between uses.8 Electric or ultrasonic brushes are acceptable if the patient is capable of using them without causing trauma and irritation.1,8 If patients are skilled at flossing without traumatizing the tissues, it is reasonable to continue flossing throughout treatment.8 Toothpicks and water irrigation devices should be avoided when the patient is pancytopenic.8,10

Diet: Dental practitioners should encourage a non-cariogenic diet and advise caretakers about the high cariogenic potential of dietary supplements rich in carbohydrate and oral pediatric medications rich in sucrose.

Fluoride: Preventive measures include the use of fluoridated toothpaste, fluoride supplements if indicated, neutral fluoride gels/rinses, or applications of fluoride varnish for patients at risk for caries and/or xerostomia. A brush-on technique is the most convenient technique making patients more compliant.8

Lip care: Lanolin-based creams and ointments are more effective in moisturizing and protecting against damage than petrolatum-based products.8,11

Education: Patient/caretaker education includes the importance of optimal oral care in order to minimize oral problems/discomfort during treatment and the possible acute and long-term effects of the therapy in the craniofacial complex.

Dental Care Only conservative emergency dental care should be provided during immunosuppression, and only after consultation with the medical team in regards to platelet and antibiotic therapy. Patients who are using plant alkaloid chemotherapeutic agents (vincristine, vinblastine) may present deep, constant pain (mostly in the mandible) in the absence of odontogenic pathology.5,8,10 The pain resolves with discontinuation of the drugs and no treatment is necessary. The patient should be seen not less often than every 6 months for an oral health evaluation during treatment, preferably in times of stable hematological status and always after reviewing the medical history and the need for endocarditis coverage if a central line is still in place.

Management of oral conditions related to cancer therapies
Mucositis: Mucositis care remains focused on palliation of symptoms and efforts to reduce the influence of secondary factors on mucositis.\textsuperscript{5,10,12} There is a variety of protocols available.\textsuperscript{1,3-10,12} Most studies do not demonstrate a prophylactic impact of chlorhexidine on mucositis.\textsuperscript{7,12}

Oral mucosal infections: The signs of inflammation and infection may be greatly diminished during neutropenic periods. Thus, the clinical appearance of infections may differ significantly from the normal.\textsuperscript{1,10} Close monitoring of the oral cavity allows for timely diagnosis and treatment of fungal, viral, and bacterial infections. Prophylaxis with nystatin for fungal infections is not effective.\textsuperscript{5,20} Oral cultures and/or biopsies of all suspicious lesions should be done and prophylactic medications should be initiated until more specific therapy can be prescribed.\textsuperscript{1,5,8-12}

Oral bleeding: Oral bleeding occurs due to thrombocytopenia, disturbance of coagulation factors, and damaged vascular integrity. Treatment should consist of local approaches (pressure packs, antifibrinolytic rinses, gelatin sponges, etc) and systemic measures (platelet transfusions).

Dental sensitivity/pain: Tooth sensitivity could be related to decreased secretion of saliva during radiation therapy and the lowered salivary pH.\textsuperscript{5,8,10}

Xerostomia: Sugar-free chewing gum, candy, suckling tablets, special dentifrices for oral dryness, saliva substitutes, frequent sipping of water, bland oral rinses, and/or oral moisturizers are recommended.\textsuperscript{8,21} Saliva stimulating drugs are not approved for use in children. Fluoride rinses and gels are recommended highly for caries prevention.

Phase III

Assessment and diagnosis

1. Place the child on a 3-month recall for the first 12 months after cancer treatment and 6 months thereafter, or as indicated by the individual patient’s needs/susceptibility to dental disease.

2. At recall visits, review current medications to determine if the child continues to receive immunosuppressive or myelosuppressive drugs.

3. At recall visits, review current blood data to assess the child’s return to a normal hematologic status. Particular attention should be paid to the WBC, differential, ANC and platelet count.


5. Educate the patient and parents about the possible long-term sequelae of chemotherapy and radiation on the craniofacial complex.

Treatment

1. Provide restorative and periodontal therapy to return the patient to an optimal state of dental health.

2. Provide symptomatic care for any residual/long-term oral lesions.

3. Restart or initiate orthodontic treatment as indicated.

Dental and Oral Care After the Cancer Therapy is Completed (Exclusive of HCT)
**Objectives:** The objectives of a dental/oral examination after cancer therapy ends are two-fold:

1. to maintain optimal oral health; and
2. to educate the patient and caretakers about the importance of optimal oral care in order to minimize oral problems/discomfort after treatment and about the possible acute and long-term effects of the therapy in the craniofacial complex.

**Preventive strategies**

**Oral hygiene:** Patients should resume normal tooth brushing 2 to 3 times daily. Brushes should be air-dried between uses. Patient should continue/resume daily flossing.

**Diet:** Dental practitioners should encourage a non-cariogenic diet and advise caretakers about the high cariogenic potential of dietary supplements rich in carbohydrate and oral pediatric medications rich in sucrose.

**Fluoride:** Preventive measures include the use of fluoridated toothpaste, fluoride supplements if indicated, neutral fluoride gels/rinses, or applications of fluoride varnish for patients at risk for caries and/or xerostomia. A brush-on technique is the most convenient technique making patients more compliant.

**Lip care:** Lanolin-based creams and ointments are more effective in moisturizing and protecting against damage than petrolatum-based products.

**Education:** Patient/caretaker education includes the importance of optimal oral care in order to minimize oral problems/discomfort after treatment and the possible acute and long-term effects of the therapy in the craniofacial complex.

**Dental Care**

**Periodic evaluation:** The patient should be seen at least every 6 months (sooner if more imperative issues such as xerostomia and trismus are present). Patients who have experienced chronic or severe mucositis should be followed closely for malignant transformation of their oral mucosa (eg, oral squamous cell carcinoma).

**Orthodontic treatment:** Orthodontic care may start or resume after completion of all therapy and at least a 2 year disease-free survival when the risk of relapse is decreased and the patient is no longer using immunosuppressive drugs. A thorough assessment of any dental developmental disturbances caused by the cancer therapy must be done before initiating orthodontic treatment. The following strategies should be considered to provide orthodontic care for patients with dental sequelae: (1) use appliances that minimize the risk of root resorption, (2) use lighter forces, (3) terminate treatment earlier than normal, (4) choose the simplest method for the treatment needs, and (5) not treat the lower jaw. However, specific guidelines for orthodontic management, including optimal force and pace, remain undefined.

**Oral surgical procedures** such as an extraction or excisional biopsy may require pre-operative and post-operative hyperbaric oxygen to avoid osteomyelitis if the patient has had previous cranial radiation therapy to the involved maxillary or mandibular area.
Specific oral complications can be correlated with phases of HCT:8,14,15

**Phase I: Pre-transplantation**

The oral complications are related to the current systemic and oral health, oral manifestations of the underlying condition, and oral complications of recent medical therapy.

*Dental and oral care before the transplant:* Most of the principles are similar to those discussed for pediatric cancer. The 2 major differences are: 1) in HCT, the patient receives all the chemotherapy and/or total body irradiation in just a few days before the transplant, and 2) there will be prolonged immunosuppression following the transplant. Elective dentistry will need to be postponed until immunological recovery has occurred, which may take as long as 9 to 12 months after HCT, or longer if chronic GVHD or other complications are present.5,8 Therefore, all dental treatment must be completed before the child is admitted in order to eliminate disease that could lead to complications during and after the transplant.

**Phase II: Conditioning/neutropenia**

The oral complications are related to the conditioning regimen and medical therapies, approximately to day 30 post-transplant.8 Mucositis, xerostomia, oral pain, oral bleeding, opportunistic infections, and taste dysfunction can be seen. The patient should be followed up closely during the hospitalization period to monitor and treat the oral changes and reinforce the importance of optimal oral care. Dental care usually is not allowed in this phase.

**Phase III: Initial engraftment to hematopoietic reconstitution**

The intensity and severity of complications begin to decrease normally 3 to 4 weeks after transplantation. Oral fungal infections and herpes simplex virus infection are most notable. Oral GVHD can become a concern for allogeneic graft recipients. A dental/oral examination should be performed and invasive dental procedures, including dental cleanings and soft tissue curettage, should be done only if authorized by the HCT team because of the patient's continued immunosuppression.8 Patients should be encouraged to continue optimal oral hygiene and avoid a cariogenic diet. Attention to xerostomia and oral GVHD treatment, including topical application of steroids or cyclosporine, and oral psoralen and ultraviolet A therapy, are a must. HCT patients are particularly sensitive to thermal stimuli between 2 and 4 months post-transplant.8 Topical application of neutral fluoride helps reduce the sensitivity.

**Phase IV: Immune reconstitution/late post-transplantation**

After day 100 post-HCT, the oral complications predominantly are related to the chronic toxicity associated with the conditioning regimen, including salivary dysfunction, craniofacial growth abnormalities, late viral infections, oral chronic GVHD, and oral squamous cell carcinoma.8 Regular dental examinations with radiographs can be done routinely, but invasive dental treatment should be avoided in patients with profound impairment of immune function.8 Orthodontic treatment considerations are the same as discussed in the previous section.
References


