LEUKEMIA & LYMPHOMA SOCIETY®

Dental and Oral Complications of Cancer Treatment

No. 29 in a series providing the latest information for patients, caregivers and healthcare professionals

Highlights

- Side effects of cancer treatment may cause a variety of problems affecting the mouth, teeth and jaw, and they impact your quality of life.
- The side effects you experience will depend on the type and duration of the treatment you receive.
- There are things you can do to decrease the risk of dental and oral problems.
- A thorough oral evaluation by a dental professional is recommended prior to treatment.
- Work closely with your entire healthcare team to manage any oral complications.
- Proper dental hygiene on an ongoing basis is essential.

Introduction

Most people are aware of common side effects of cancer treatment such as nausea and hair loss. However, most people do not know that patients who undergo cancer treatment often develop complications that affect the mouth. Complications are medical problems that occur as a result of a procedure, treatment or illness. Oral complications affect the mouth. Cancer patients have a high risk of oral complications.

This publication will focus on possible oral complications for a patient with blood cancers such as leukemia, lymphoma, myeloma, myelodysplastic syndromes (MDS) and myeloproliferative neoplasms (MPNs). These diseases affect the bone marrow, the blood cells, the lymph nodes and other parts of the lymphatic system. Patients with solid-tumor cancers (such as breast or lung) may also experience oral complications from cancer treatment; however, these will not be discussed here.

Many cancer treatments, particularly chemotherapy and radiation, can affect an individual's dental and oral health. The term "dental and oral health" refers to the well-being of the entire mouth, including the teeth, gums, lining of the mouth (mucosa), glands that produce saliva (salivary glands), and the jaw.

Oral complications can make it difficult to eat, talk, chew or swallow. These problems can affect the patient's health and quality of life. They can even affect a patient's ability to complete cancer treatment.

In some cases when oral complications are severe, the effects on cancer treatment can be significant. For example:

- Treatment doses may need to be lowered.
- Treatment schedules may need to be changed.
- Treatment may be delayed.
- Treatment may be stopped altogether.

Oral complications occur in nearly 40 percent of patients who receive chemotherapy, more than 75 percent of patients who have a stem cell transplant, and in nearly all patients who receive radiation for head and neck malignancies. Surgery involving removal of a tumor (an abnormal mass of tissue) in the head or neck may result in changes involving oral function.

Before treatment begins, it is important for patients to understand the causes of oral complications and how to treat them in order to reduce symptoms and improve quality of life.

Understanding How Treatment Affects Oral Health

Many cancer patients are at high risk for oral complications due to their cancer treatment or the side effects of cancer treatment. The severity of side effects depends on the individual and on the cancer treatment itself. See **Table 1** (on page 2) for a list of possible oral complications due to chemotherapy, radiation, and graft-versus-host disease (GVHD) following a stem cell transplant.

Table 1. Possible Oral Side Effects of Treatment

Side Effect	Complications	Chemotherapy (with or without transplant)	Radiation to the Head and Neck	GVHD (after transplant)
Mouth sores, also called oral mucositis	Inflammation (redness, swelling, warmth) and ulceration (breaks in the skin or lining) of the mucous membranes may cause pain and increase the risk of infection.	X	X	X
Bleeding in the mouth	Oral bleeding may result from the decreased number of platelets in the blood due to the effects of chemotherapy on the bone marrow.	X		
Dry mouth (xerostomia)/ salivary gland dysfunction	Xerostomia occurs as a result of less saliva in the mouth and can affect speaking, chewing, opening the mouth, and swallowing. Dry mouth for long periods of time can also increase the risk of tooth decay and cavities.	X	X	X
Tooth decay and gum disease	Both can become significant issues due to changes in the lining of the mouth and salivary glands, which upset the balance of bacteria in the mouth.	X	X	X
Infection	Viral, bacterial and fungal infections can become problematic because of low white blood cell counts, dry mouth or damage to the mucosa (lining of the mouth). Infections that start in the mouth can travel throughout the bloodstream and affect cells in other parts of the body.	X	X	X
Pain	Pain is associated with nearly all oral problems. It includes mouth sensitivity to acidic foods, spices, carbonated beverages, alcohol, and flavorings such as mint.	X	X	X
Difficulty swallowing (dysphagia)	This occurs when a person has trouble getting food or liquid to pass down from the mouth to the throat. People may gag, cough or choke when trying to swallow, while others may feel like food is stuck in their throat.	X	X	X
Changes in taste (dysgeusia)	Foods may taste sour, sweet, bitter or metallic, or there may be a bad taste in the mouth.	X	X	X
Neurotoxicity (nerve damage)	This may be a side effect of radiation therapy or from a certain class of drugs used in chemotherapy called “vinca alkaloids,” such as **vincristine (Oncovin®)** and **vinblastine (Velban®).** An aching, burning pain similar to toothache may occur.	X	X	
Changes in dental growth and development (in children)	Permanent teeth may be affected. There is a higher risk of dental defects.	X	X	

Continued on page 3.

Dental and Oral Complications of Cancer Treatment

Side Effect	Complications	Chemotherapy (with or without transplant)	Radiation to the Head and Neck	GVHD (after transplant)
Malnutrition or dehydration	Both can develop when a person cannot eat or drink due to mouth sores, dry mouth, pain, changes in taste or difficulty swallowing.	X	X	X
Difficulty opening the mouth (trismus), also known as lockjaw	Breakdown of tissue, bone or muscle in the mouth area after treatment (or from GVHD) can make it hard for patients to open their mouths. This affects nutrition, oral hygiene and the ability to have dental procedures.		X	X
Fibrosis	The process of thickening and scarring of tissue in the mucous membranes or muscle.		X	X
Sclerosis and tightness in the skin or in the lining of the mouth	Abnormal hardening of skin or tissue may occur. Patients may experience a pulling sensation.			X
Osteonecrosis of the jaw (due to medications) and osteoradio-necrosis (due to radiation)	A rare condition in which the loss of blood flow to bone cells in the jaw causes the cells to break down, die and expose bone.	X*	X	

Abbreviation: GVHD, graft-versus-host disease (See *Stem Cell Transplant* on page 4).

*Due to antiresorptive therapies, also called bone-modifying drugs (such as bisphosphonates or denosumab), or anti-VEGF-targeted therapies (VEGF, vascular endothelial growth factor, is a substance made by cells that stimulates new blood vessel formation).

Chemotherapy. Chemotherapy drugs slow or stop the growth of fast-growing cells such as cancer cells. They may also harm normal, healthy fast-growing cells, including cells in the mouth. Chemotherapy can prevent the growth of normal cells in the lining of the mouth, which affects the ability of oral tissue to repair itself by making new cells. This results in mouth sores (mucositis).

Chemotherapy may also cause a decrease in the number of white blood cells, the cells that fight infection. As a patient's white blood cell count gets lower, infections may occur more frequently. Over time, it can become more difficult for the body to fight off bacterial, viral and fungal infections.

Chemotherapy may disturb the healthy balance of bacteria in the mouth. There are many kinds of bacteria in the mouth. Some bacteria are helpful, and some are harmful. The "good" bacteria keep the "bad" bacteria in balance. If that balance is disrupted, the resulting changes may lead to problems with a patient's oral health.

Most of the oral complications caused by chemotherapy are short-term and typically resolve after treatment ends.

Radiation to the Head and Neck. Radiation therapy may directly damage oral tissue, salivary glands and bone. Areas treated by radiation may scar or atrophy (waste away).

Common oral complications from radiation therapy include:

- Mucositis/mouth sores—inflammation and ulceration of the mucous membranes
- Salivary gland dysfunction—decreased saliva production leading to difficulty swallowing, taste changes, speech problems, yeast infection
- Increased risk of dental caries/tooth decay—damage to the hard tissues of the teeth

While radiation therapy may cause short-term complications, it can also cause permanent tissue damage that puts a patient at risk for lifelong oral complications. A rare complication of radiation therapy to the head and neck is called osteoradionecrosis (bone death).

Cancer cells are particularly sensitive to radiation and are damaged by it; normal tissue cells will eventually repair themselves. Therefore, most of the side effects caused by radiation therapy will eventually subside after treatment is completed.

Stem Cell Transplant. The high doses of chemotherapy typically used before a stem cell transplant may cause dental and oral side effects. Patients who receive an allogeneic stem cell transplant (with cells from a donor or cord blood) have an increased risk of graft-versus-host disease (GVHD). GVHD occurs when transplanted donor cells attack the patient's body. Acute GVHD usually occurs during the first three months after transplant and typically involves the skin, gastrointestinal system (stomach and intestines), and the liver. Chronic GVHD usually occurs later and has a broader impact, affecting more organs and tissues.

Oral complications of chronic GVHD can include:

- Inflammation, thinning and ulceration of oral mucosal tissues. There may be redness and "lacy" white patches in the mouth. This can resemble lichen planus, an itchy rash causing burning or soreness.
- Salivary gland dysfunction. May cause dry mouth or the development of blisters, leading to difficulty chewing and swallowing, taste changes, and increased risk of dental caries (tooth decay or cavities).
- Decreased oral opening (trismus). The mouth feels tight, and it may be difficult or painful to open the mouth for normal functions.

Visit www.LLS.org/booklets to view the free LLS booklets *Blood and Marrow Stem Cell Transplantation* and *Graft-Versus-Host Disease* for more information.

Surgery. Surgery has a limited role in treating blood cancers. Because blood cancers affect the bone marrow, blood, and lymphatic tissue, surgery to remove the cancer usually isn't possible or effective. However, in rare cases surgery may be used to remove isolated, localized disease in the head, neck or other parts of the body. Surgical removal of tissue or bone may affect a patient's appearance and oral function. Possible side effects of surgery, as with any type of surgery, include risk of infection, bleeding, swelling and pain.

Targeted Therapy. Targeted therapy uses drugs or other substances to identify and attack specific types of cancer cells, generally with less harm to normal cells. However, some targeted therapies can have negative side effects that affect the mouth by causing mucositis, infection or salivary gland dysfunction. Tyrosine kinase inhibitors are one type of targeted therapy. (See *Health Terms* on page 10.)

Immunotherapy. Immunotherapy utilizes your own immune system to fight cancer, and generally results in fewer short-term side effects than chemotherapy. Common effects of immunotherapy on the mouth include mucositis, taste changes and salivary gland dysfunction. There are different types of immunotherapy, including immune checkpoint inhibitors and chimeric antigen receptor (CAR) T-cell therapies.

Visit www.LLS.org/booklets to view the free LLS booklets *Immunotherapy* and *Chimeric Antigen Receptor (CAR) T-Cell Therapy* for more information.

Bone-Modifying Drugs. Bisphosphonates are a class of drugs that prevent bone loss. They are often prescribed to patients with myeloma (cancer of the plasma cells) because myeloma can dissolve, weaken and even break bones. Bisphosphonates can help bones stay strong by slowing down this destructive process. Common bisphosphonates for treating bone problems in people with myeloma are **pamidronate (Aredia®)** and **zoledronic acid (Zometa®).** Patients should understand that although bisphosphonates are effective, these drugs can also cause risk to their dental health.

Denosumab (Prolia® or Xgeva®) may also be prescribed to reduce the risk of fractures in people with myeloma or certain other cancers that have spread to the bones. Denosumab is a monoclonal antibody (a type of protein made in the laboratory) that binds to a protein called RANKL on the surface of certain bone cells. It keeps bone from breaking down and prevents cancer cells from growing.

Bisphosphonate treatment or denosumab can both cause a rare but serious side effect called "osteonecrosis of the jaw" or "ONJ." ONJ causes part of the jaw bone to die, which can lead to pain, open sores and higher risk of tooth loss and infection. Patients should have a dental check-up before starting treatment with bisphosphonates or denosumab, and address any dental problems before treatment begins.

Before Cancer Treatment

Good dental hygiene, before and during cancer treatment, may help to either prevent or decrease associated oral complications. Patients should learn about proper dental care so they can lessen side effects and manage symptoms. The goal is to treat existing

oral problems before cancer treatment begins and to become educated about the potential risks, side effects and complications of cancer therapy.

Ideally, patients should visit a dentist at least four weeks before treatment starts. A pretreatment oral evaluation will identify problems such as cavities, fractured teeth, loose crowns or fillings, or gum disease. These issues should all be addressed in order to reduce the risk of oral complications. During the pretreatment evaluation, the patient and dentist should discuss:

- Potential oral complications caused by cancer treatments
- Ways to improve dental and oral health during treatment
- Steps to maintain healthy nutrition
- How to prevent infection and decrease risks
- Any concerns regarding the patient's oral health

It is important for patients to tell their dentist about all their medications and cancer treatments so they can avoid adverse side effects during dental treatment.

Cancer treatment can lower the body's immune response, making it easier for infection to develop and bacteria to spread. Because dental cavities and gum disease are bacterial infections, they should be treated before, during and after cancer therapies to reduce the risk of bacteria infecting other parts of the body.

Dental professionals should consult with the healthcare team regarding the patient's health status, especially blood counts (red blood cells, white blood cells and platelets), before any invasive procedures, and follow established guidelines. For patients with implanted devices, such as a catheter or port, antibiotics may be recommended to prevent infection.

When dental problems are treated before cancer treatments begin, there may be fewer or less severe oral complications.

During Cancer Treatment

To decrease the risk of complications such as cavities, mouth sores and infections during treatment, it is important to keep the mouth, teeth and gums clean. Patients can take the following steps to help improve their oral health:

- Brush teeth, gums and tongue two to three times a day with a soft nylon bristle toothbrush or an electric toothbrush.
- Use a fluoride toothpaste with a mild taste—flavorings can irritate the mouth.
- Gently floss once a day.
- Rinse the mouth frequently (every 4-6 hours) with a solution of water, salt and baking soda, to prevent soreness.
- Use an alcohol-free antibacterial rinse two to four times a day to prevent gum disease. An alcohol-free chlorhexidine solution may also be recommended.
- Use a lip-care product (such as lanolin-based creams and ointments) to prevent your lips from drying and cracking.
- Brush dentures every day, clean with a denture cleaner recommended by the dentist, and keep dentures moist when not being worn.
- Pay attention to diet. Try to:
    - Choose healthy foods that are mild, soft, and easy to chew and swallow.
    - Avoid hot, spicy, highly acidic and crunchy foods that may irritate your mouth.
    - Avoid sugary foods, like candy or soda, which can cause cavities.
    - Avoid alcohol and tobacco products.
- Keep your mouth moist during cancer treatments so you are more likely to avoid mouth sores. You can:
    - Drink a lot of water.
    - Suck on ice chips to prevent dryness.
    - Chew sugarless gum or suck on hard candy.
    - Use a saliva substitute.
- Ask about fluoride treatments that may be recommended to prevent cavities or tooth sensitivity.
- Talk with your healthcare team about ways to improve bone health with vitamin D and/or calcium supplements.
- Practice oral stretching exercises on a daily basis if you're undergoing radiation treatment for head and neck cancer (to avoid problems opening and closing your mouth).
- Look in your mouth every day and note sores or other changes. Let your healthcare team know of any issues.

Management of Complications

Contact a member of your healthcare team if you notice oral complications. The patient, doctor and dentist should work together to manage symptoms and treat complications with medication and/or supportive care. Supportive care can include pain management, nutritional advice, counseling, complementary therapies and more.

- **Mouth rinses.** Mouth rinses that contain baking soda and salt, over-the-counter rinses, or prescription rinses may soothe sore spots in the mouth.
- **Pain medications.** Pain medications, including some narcotics, may be used to relieve mouth pain. **Visit www.LLS.org/booklets to view the free LLS booklet *Pain Management* for more information.**
- **Antibiotics.** Antibiotics, antiviral drugs, or antifungal drugs are used to treat infections.
- **Other prescription medications.** Oral gels and medications that will increase saliva may be prescribed.

Children

In general, many of the same concepts for managing oral and dental complications in adults apply to children in cancer treatment.

Children are at risk for problems in dental (tooth) development and craniofacial (relating to the bones of the skull and face) growth, especially those under the age of 6 undergoing chemotherapy and/or treated with total body irradiation. Children should be carefully monitored by professionals such as a pediatric dentist and a pediatric oncologist. See *Your Healthcare Team* in the next column.

Children who have undergone cancer treatment may develop dental and craniofacial problems later in life. They are at higher risk for dental caries (tooth decay and cavities), dry mouth, missing or smaller-than-normal size teeth, deficient tooth enamel (outer covering), and abnormally-shaped roots of the teeth.

For children undergoing orthodontic treatment when diagnosed with cancer, removal of orthodontic appliances and replacement with removable retainers may be recommended. Routine daily cleaning of any appliances or retainers (and their cases) is essential. The American Academy of Pediatric Dentistry recommends orthodontic care to start or resume after completion of all therapy and after at least a two-year disease-free survival when the risk of relapse is decreased and the patient is no longer using immunosuppressive drugs.

After Cancer Treatment

When cancer treatment has finished, it is important to:

- Visit your dentist as soon as appropriate after completing your treatment.
- Treat any dental issues that may arise.
- Maintain optimal oral health and dental care for life.

Your Healthcare Team

Your healthcare team will help you manage any dental or oral complications of cancer treatment. In addition to your hematologist-oncologist (the doctor who specializes in treating cancers of the blood) and your dentist (the doctor who treats conditions affecting the teeth, gums and the mouth), patients may visit with one or more other practitioners, including the following:

- Dental oncologist or oral medicine specialist—A doctor who specializes in monitoring and treating any oral issues due to cancer treatment such as chemotherapy and radiation therapy
- Dietitian—A health professional with special training in diet and nutrition
- Oncology nurse—A registered nurse with advanced training specializing in working with patients who have cancer
- Oral and maxillofacial surgeon—A dentist with special training to correct diseases, injuries and defects of the face, jaw or mouth
- Pediatric dentist—A dentist who specializes in providing oral healthcare for infants and children through adolescence
- Pediatric oncologist—A doctor who specializes in diagnosing and treating children with cancer
- Periodontist—A dentist who specializes in the prevention, diagnosis and treatment of periodontal disease (a chronic inflammatory disease that affects the gums and bone supporting the teeth) and in the placement of dental implants
- Prosthodontist—A dentist who specializes in treating complex dental and facial matters (including the restoration and replacement of missing or damaged teeth) with artificial devices such as dentures, crowns and implants
- Social worker—A trained professional devoted to helping people work through challenges they face in everyday life

- Speech therapist (also known as a speech-language pathologist)—A health professional who works to diagnose and treat speech, language, communication and swallowing disorders in children and adults

Psychosocial Concerns

Oral complications of cancer treatment can affect basic human activities such as eating and speaking, and thereby impact a person's state of mind and quality of life. For instance, a patient may feel frustrated or withdraw from social activities. Supportive care from the healthcare team (such as close monitoring of symptoms and effective pain management) and from the patient's family (such as emotional support and assistance with practical needs) can help the patient cope with cancer and the effects of treatment.

Financial Implications

Paying for dental care is a concern for many cancer patients. Not everyone can afford dental insurance, and dental benefits are not always an option. This lack of dental coverage and financial strain have made access to proper dental care for cancer patients a common problem in the United States.

It is important for patients to educate themselves about their medical and dental insurance coverage and its limitations before they begin cancer treatments. For instance, traditional Medicare does not cover routine dental care. Some Medicare Advantage Plans include limited dental coverage (make sure to read the fine print). In unique circumstances, Medicare may cover dental services, such as those needed prior to receiving radiation treatment for certain jaw-related diseases (like oral cancer) or reconstruction of part of the jaw (if necessary) when a facial tumor is removed. Medicaid may or may not cover dental care, depending on your state. Patients should share their financial concerns with their medical and dental teams and find out if there are any financial resources available to them. See *Other Resources* on pages 9–10 for organizations that may be able to help.

Feedback

Visit **www.LLS.org/PublicationFeedback** to make suggestions about this booklet.

Acknowledgement

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We're Here to Help

LLS is the world's largest voluntary health organization dedicated to funding blood cancer research, education and patient services. LLS has regions throughout the United States and in Canada. To find the region nearest to you, visit our website at www.LLS.org/LocalPrograms or contact an Information Specialist at (800) 955-4572.

LLS offers free information and services for patients and families affected by blood cancers. This section lists various resources you may find helpful.

For Help and Information

Consult with an Information Specialist. Information Specialists can assist you through cancer treatment and financial and social challenges, and provide accurate, up-to-date disease, treatment and support information. Our Information Specialists are highly trained oncology social workers and nurses. Language services are available. For more information, please:

- Call: (800) 955-4572 (Monday through Friday, 9 a.m. to 9 p.m. ET)
- Email and Live chat: www.LLS.org/InformationSpecialists

Clinical Trials (Research Studies). Research is ongoing to develop new treatment options for patients. LLS offers help for patients and caregivers in understanding, identifying and accessing clinical trials. Pediatric and

adult patients and caregivers can work with our Clinical Trial Nurse Navigators who will help find clinical trials and provide personalized support throughout the entire clinical trial process. Visit www.LLS.org/CTSC for more information.

Nutrition Consultations. Schedule a free one-on-one nutrition consultation with one of our registered dietitians who have expertise in oncology nutrition. Consultations are available to patients of all cancer types and their caregivers. Dietitians can assist with information about healthy eating strategies, side effect management and more. Please visit www.LLS.org/nutrition for more information.

Free Information Booklets. LLS offers free education and support booklets for patients, caregivers and healthcare professionals that can either be read online or ordered. Please visit www.LLS.org/booklets for more information.

Telephone/Web Education Programs. LLS offers free telephone/Web and video education programs for patients, caregivers and healthcare professionals. Please visit www.LLS.org/programs for more information.

Financial Assistance. LLS offers financial support to eligible individuals with blood cancer for insurance premiums, co-pays, and non-medical expenses like travel, food, utilities, housing, etc. For more information, please:

- Call: (877) 557-2672
- Visit: www.LLS.org/finances

Resources for Families. Blood cancer occurs in a small number of children. Families face new challenges, and the child, parents and siblings may all need support. LLS has many materials for families including a caregiver workbook, children's book series, an emotion flipbook, dry erase calendar, coloring books and a coloring app, a school re-entry program, and other resources. For more information, please

- Call: (800) 955-4572
- Visit: www.LLS.org/FamilyWorkbook

Podcast. *The Bloodline with LLS* is here to remind you that after a diagnosis comes hope. Listen in as patients, caregivers, advocates, doctors and other healthcare professionals discuss diagnosis, treatment options, quality-of-life concerns, treatment side effects, doctor-patient communication and other important survivorship topics. Visit www.LLS.org/TheBloodline for more information and to subscribe to access exclusive content, submit ideas and topics, and connect with other listeners.

3D Models. LLS offers interactive 3D images to help visualize and better understand blood cell development, intrathecal therapy, leukemia, lymphoma, myeloma, MDS, MPNs, and lab and imaging tests. Visit www.LLS.org/3D for more information.

Free Mobile Apps.

- LLS Coloring For Kids™ – Allows children (and adults) to express their creativity and offers activities to help them learn about blood cancer and its treatment. Visit www.LLS.org/ColoringApp to download for free.
- LLS Health Manager™ – Helps you track side effects, medication, food and hydration, questions for your doctor, and more. Visit www.LLS.org/HealthManager to download for free.

Suggested Reading. LLS provides a list of selected books recommended for patients, caregivers, children and teens. Visit www.LLS.org/SuggestedReading to find out more.

Connecting with Patients, Caregivers and Community Resources

LLS Community. The one-stop virtual meeting place for talking with other patients and receiving the latest blood cancer resources and information. Share your experiences with other patients and caregivers and get personalized support from trained LLS staff. Visit www.LLS.org/community to join.

Weekly Online Chats. Moderated online chats can provide support and help cancer patients and caregivers reach out and share information. Please visit www.LLS.org/chat for more information.

Local Programs. LLS offers community support and services in the United States and Canada including the *Patti Robinson Kaufmann First Connection® Program* (a peer-to-peer support program), local support groups and other great resources. For more information about these programs or to contact your region, please:

- Call: (800) 955-4572
- Visit: www.LLS.org/LocalPrograms

Advocacy and Public Policy. Working closely with dedicated volunteer advocates, LLS's Office of Public Policy elevates the voices of patients to state and federal elected officials, the White House, governors and even courts. Together, we advocate for safe and effective treatments. We pursue policies that would make care more accessible to all patients. And, most of all, we advocate for the hope for a cure. Want to join our work? Visit www.LLS.org/advocacy for more information.

Other Helpful Organizations. LLS offers an extensive list of resources for patients and families. There are resources that provide help with financial assistance, counseling, transportation, patient care and other needs. For more information, please visit www.LLS.org/ResourceDirectory to view the directory.

Additional Help for Specific Populations

Información en Español (LLS information in Spanish). Please visit www.LLS.org/espanol for more information.

Language Services. Let members of your healthcare team know if you need translation or interpreting services because English is not your native language, or if you need other assistance, such as a sign language interpreter. Often these services are free.

Information for Veterans. Veterans who were exposed to Agent Orange while serving in Vietnam may be able to get help from the United States Department of Veterans Affairs. For more information, please

- Call: the VA (800) 749-8387
- Visit: www.publichealth.va.gov/exposures/AgentOrange

Information for Firefighters. Firefighters are at an increased risk of developing cancer. There are steps that firefighters can take to reduce the risk. Please visit www.LLS.org/FireFighters for resources and information.

World Trade Center Health Program. People involved in the aftermath of the 9/11 attacks and subsequently diagnosed with a blood cancer may be able to get help from the World Trade Center (WTC) Health Program. People eligible for help include:

- Responders
- Workers and volunteers who helped with rescue, recovery and cleanup at the WTC-related sites in New York City (NYC)
- Survivors who were in the NYC disaster area and those who lived, worked or were in school in that area
- Responders to the Pentagon and the Shanksville, PA, crashes

For more information, please

- Call: WTC Health Program at (888) 982-4748
- Visit: www.cdc.gov/wtc/faq.html

People Suffering from Depression. Treating depression has benefits for cancer patients. Seek medical advice if your mood does not improve over time, for example, if you feel depressed every day for a two-week period. For more information, please:

- Call: The National Institute of Mental Health (NIMH) at (866) 615-6464
- Visit: NIMH at www.nimh.nih.gov and enter "depression" in the search box

Other Resources

American Academy of Pediatric Dentistry (AAPD)
https://www.aapd.org

The mission of the American Academy of Pediatric Dentistry is to advance optimal oral health for all children by delivering outstanding service that meets and exceeds the needs and expectations of members, partners and stakeholders. AAPD provides a "Find a Pediatric Dentist" search tool, resources for parents, and access to *Oral Health Policies & Recommendations (The Reference Manual of Pediatric Dentistry)* online.

American Dental Association (ADA)
https://www.ada.org/

The mission of the American Dental Association is to help dentists succeed and support the advancement of health of the public. One of its community initiatives is the Find-a-Dentist search tool. Visit https://findadentist.ada.org/ and enter your zip code to find an ADA member dentist.

Dental Lifeline Network
https://dentallifeline.org
(303) 534-5360

Dental Lifeline Network is a national charitable organization whose mission is to improve the oral health of people with disabilities, the elderly, and/or the medically at-risk, who have no other way to get help. Their Donated Dental Services program provides qualified individuals with free comprehensive dental treatment through a volunteer network of dentists and dental laboratories.

HRSA Bureau of Primary Health Care
https://findahealthcenter.hrsa.gov/
(877) 474-4772

The Health Resources & Services Administration (HRSA) is an agency of the U.S. Department of Health and Human Services. The HRSA Bureau of Primary Health Care funds nearly 1,400 health centers, providing access to affordable, comprehensive, high-quality, primary health care services for people who are low-income, uninsured, or face other obstacles to getting healthcare. Health

centers provide services that include check-ups and treatment and may also provide dental health services. Enter your zip code in the "Find a Health Center" search box. Patients should contact the health center directly to confirm the availability of specific services and to make an appointment.

Medicare Rights Center
www.medicarerights.org
(800) 333-4114

The Medicare Rights Center is a national, nonprofit consumer service organization that works to ensure access to affordable healthcare for older adults and people with disabilities through counseling and advocacy, educational programs and public policy initiatives.

Health Terms

Chimeric Antigen Receptor (CAR) T-Cell Therapy. CAR T-cell therapy is a type of treatment in which a patient's T cells are changed in the laboratory so they will bind to cancer cells and kill them. **Visit www.LLS.org/booklets to view the free LLS booklet *Chimeric Antigen Receptor (CAR) T-Cell Therapy.***

Dysgeusia. Dysgeusia is a taste disorder in which foods taste sour, sweet, bitter or metallic. There may be a bad taste in the mouth, even without eating anything.

Dysphagia. Dysphagia is the medical term for difficulty swallowing foods or liquids.

Fibrosis. Fibrosis is the abnormal thickening or scarring of tissue.

Graft-Versus-Host Disease (GVHD). GVHD is a condition that occurs after an allogeneic stem cell transplant when donated stem cells or bone marrow (the graft) see the healthy tissues in the patient's body (the host) as foreign and attack them. GVHD can cause severe damage to tissues and organs. **Visit www.LLS.org/booklets to view the free LLS booklet *Graft-Versus-Host Disease.***

Immune Checkpoint Inhibitors. These drugs work by blocking checkpoint proteins on the surface of T cells from binding with their partner proteins. This prevents the "off" signal from being sent, allowing the T cells to kill cancer cells. Examples are **nivolumab (Opdivo®)** and **pembrolizumab (Keytruda®).**

Immunotherapy. A type of therapy that uses substances to stimulate or suppress the immune system to help the body fight cancer, infection and other diseases. **Visit www.LLS.org/booklets to view the free LLS booklet *Immunotherapy* for more information.**

Monoclonal Antibodies. Monoclonal antibodies are immune proteins made in a laboratory. They are designed to react with or attach to antigens (foreign substances such as bacteria, viruses, fungi and allergens) on the surface of cancer cells. Monoclonal antibodies can be used alone or to carry drugs, toxins or radioactive substances directly to cancer cells. Examples of monoclonal antibodies are **rituximab (Rituxan®)** and **obinutuzumab (Gazyva®).**

Neurotoxicity. Neurotoxicity occurs when exposure to natural or man-made toxic substances alters the normal activity of the nervous system. In other words, this exposure disrupts or kills neurons (the cells that transmit and process signals in the brain and other parts of the nervous system).

Osteonecrosis of the Jaw (ONJ) and Osteoradionecrosis. ONJ is a rare but serious side effect of certain medications in which the bone cells in the jaw break down and die. Osteoradionecrosis can occur in people who receive high doses of radiation, especially to the jaw. The radiation decreases the bone's blood supply, so the bone gets less oxygen than it needs, resulting in the death of bone tissue.

Targeted Therapy. Targeted therapy is the use of drugs or substances to identify and attack specific types of cancer cells. They may block the action of certain enzymes, proteins or other molecules to stop the growth and spread of cancer, help the immune system kill cancer cells, or deliver toxic substances directly to cancer cells to kill them. Types of targeted therapy include monoclonal antibodies, chimeric antigen receptor (CAR) T-cell therapy, tyrosine kinase inhibitors, and various other inhibitors. One goal of targeted therapy is to leave normal, healthy cells mostly intact.

Trismus. Trismus, also known as lockjaw, is the inability to fully open the mouth.

Tyrosine Kinase Inhibitors (TKIs). TKIs are drug therapies that block the action of a specific abnormal protein that gives cancer cells the signal to grow. For example, there are several TKIs available that target the abnormal BCR-ABL1 protein in the treatment of chronic myeloid leukemia (CML).

Xerostomia. Xerostomia, also known as dry mouth, is the condition in which the salivary glands in the mouth don't make enough saliva to keep the mouth wet.

References

American Academy of Pediatric Dentistry. Dental management of pediatric patients receiving immunosuppressive therapy and/or head and neck radiation. 2022. https://www.aapd.org/globalassets/media/policies_guidelines/bp_chemo.pdf

American Dental Association. Cancer therapies and dental considerations. https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/cancer-therapies-and-dental-considerations Accessed March 1, 2023.

Cancer.Net [online]. Dental and oral health. https://www.cancer.net/coping-with-cancer/physical-emotional-and-social-effects-cancer/managing-physical-side-effects/dental-and-oral-health Accessed October 31, 2022.

Cancer.Net [online]. Side effects of surgery. https://www.cancer.net/navigating-cancer-care/how-cancer-treated/surgery/side-effects-surgery Accessed December 14, 2022.

Davis DD, Hanley ME, Cooper JS. Osteoradionecrosis. *StatPearls* [online]. Continuing Education Activity. 2022. https://www.ncbi.nlm.nih.gov/books/NBK430818/

Dean D, Sroussi H. Oral chronic graft-versus-host disease [review]. *Frontiers in Oral Health*. 2022;(20)3:905154. https://doi.org/10.3389/froh.2022.903154

Elad S, Raber-Durlacher J, Brennan MT, et al. Basic oral care for hematology-oncology patients and hematopoietic stem cell recipients: a position paper from the joint task force of the Multinational Association of Supportive Care in Cancer/International Society of Oral Oncology (MASCC/ISOO) and the European Society for Blood and Marrow Transplantation (EBMT). *Supportive Care in Cancer.* 2015;23(1):223-236. https://doi.org/10.1007/s00520-014-2378-x

Gurenlian JR, Brenchley L. Oral effects of hematopoietic stem cell transplant therapy. *Decisions in Dentistry* [online]. 2019. https://decisionsindentistry.com/article/oral-effects-hematopoietic-stem-cell-transplant-therapy/

Harris JA, Ottaviani G, Treister NS, et al. An overview of clinical oncology and impact on oral health. *Frontiers in Oral Health.* 2022;3:874332. https://doi.org/10.3389/froh.2022.874332

Klein BA, Shazib MA, Villa A. Immune checkpoint inhibitors in cancer therapy: review of orofacial adverse events and role of the oral healthcare provider. *Frontiers in Oral Health.* 2022;3:968157. https://doi.org/10.3389/froh.2022.968157

National Cancer Institute. Oral complications of chemotherapy and head/neck radiation (PDQ) - Health Professional Version. https://www.cancer.gov/about-cancer/treatment/side-effects/mouth-throat/oral-complications-hp-pdq Accessed November 9, 2022.

National Cancer Institute. Oral complications of chemotherapy and head/neck radiation (PDQ) - Patient Version. https://www.cancer.gov/about-cancer/treatment/side-effects/mouth-throat/oral-complications-pdq Accessed November 7, 2022.

National Institute of Dental and Craniofacial Research. Cancer treatments and oral health. https://www.nidcr.nih.gov/health-info/cancer-treatments Accessed November 9, 2022.

Ritwik P. Dental care for patients with childhood cancers. *The Ochsner Journal.* 2018;18(4):351-357. https://doi.org/10.31486/toj.18.0061

Spivakovsky S, Nichols G, Romundstad L, et al. Blood cancers and oral health. *Journal of the Michigan Dental Association* [online]. April 2020. https://www.michigandental.org/Portals/pro/Journals/April%202020/html5/index.html

Stolze J, Boor M, Hazenberg M, et al. Oral health-related quality of life of patients with oral chronic graft-versus-host disease. *Supportive Care in Cancer.* 2021;29(11):6353-6360. https://doi.org/10.1007/s00520-021-06197-7

Yarom N, Shapiro CL, Peterson DE, et al. Medication-related osteonecrosis of the jaw: MASCC/ISOO/ASCO clinical practice guideline. *Journal of Clinical Oncology.* 2019;37(25):2270-2290. https://doi.org/10.1200/jco.19.01186