### CHEMOTHERAPY
(also known as “chemo”, “cancer chemotherapy”, “cancer medication therapy”, and “cytotoxic therapy”)

*Note: This fact sheet focuses on systemic chemotherapy for cancer unless otherwise specified. High-dose chemotherapy is further addressed in the [Bone Marrow Transplantation and Blood Stem Cell Transplantation fact sheet](#).*

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#### Is the initiation of non-invasive dental hygiene procedures* contra-indicated?**
No.

- **Is medical consult advised?**
  - Yes, if the patient/client is experiencing oral ulcerations and pain, is suspected of having active infection, or is suspected of having elevated bleeding tendency. Also, the dental hygienist should ascertain if radiation therapy is also planned.

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#### Is the initiation of invasive dental hygiene procedures contra-indicated?**
Yes. Active chemotherapy may affect appropriateness or safety, and scaling and root planing, including curetting of surrounding tissue, are contraindicated until the patient/client is medically cleared. In some cases, immunosuppression that warrants antibiotic prophylaxis and/or a bleeding disorder (thrombocytopenia) may be present.

- **Is medical consult advised?**
  - As above. Additionally, the patient/client’s oncologist should be consulted regarding the safest time to schedule an appointment, and dental hygiene instrumentation may need to be altered to accommodate the patient/client’s physical condition. Specifically, the oncologist should be consulted regarding the status of blood counts (white and red cells), platelets, and clotting factors. If dental hygiene procedures are absolutely necessary during periods of significant thrombocytopenia, platelet support therapy may be arranged by the oncologist.
  - Pre-chemotherapy, the patient/client should be referred to a dentist for consideration of selective teeth extraction (for poor lifelong prognosis and/or for patient/client lack of interest in saving teeth) and to a physician for potential prophylactic antiviral therapy during chemo if there is a tendency towards recurrent oral *herpes simplex* eruptions.

- **Is medical clearance required?**
  - Yes. Inappropriately timed dental hygiene (and dental) procedures in an immunosuppressed patient/client can result in bacteremia, potentially leading to sepsis and even death. As well, bleeding risk needs to be assessed. During cancer chemotherapy, invasive dental hygiene treatment should be undertaken only on an emergency basis (and with appropriate precautions); for example, in order to remove a source of infection, periodontal cleaning may be indicated if the patient/client’s oral hygiene has been neglected and he/she has active severe periodontal disease. Blood work should be conducted 24 hours before dental hygiene treatment to determine if the patient/client’s platelet count, clotting factors, and absolute neutrophil count are sufficient to prevent hemorrhage and infection.

- **Is antibiotic prophylaxis required?**
  - Possibly. If invasive procedures are deemed necessary, the patient/client’s oncologist may recommend prophylaxis, particularly if the client/patient has an indwelling central venous catheter1 for chemo delivery. Prophylactic antibiotics may be recommended if the white blood cell (WBC) count is <2000/μL, or the neutrophil count is <1000/μL (500/μL in some institutions).

- **Is postponing treatment advised?**
  - Possibly. Elective invasive procedures should be deferred until after chemotherapy-induced immunosuppression ceases; specifically, treatment should be postponed until the patient/client’s absolute neutrophil count is >1000/μL and granulocyte2 count is >2000/μL to reduce risk of infection. Patients/clients who are neutropenic should not undergo invasive dental hygiene procedures without special precautions. Also, elective treatment should be deferred until a platelet count > 50,000/μL (>75,000/μL in some institutions) has been achieved in order to reduce the risk of severe bleeding. Postponement may also be indicated if abnormal clotting factors are present. For outpatient/client routine care, WBC/granulocyte/neutrophil and platelet levels are generally satisfactory 17 days after chemotherapy administration or a few days before the next chemo cycle begins.

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1 also known as a Hickman line
2 Granulocytes are certain specialized white blood cells, including neutrophils, basophils, and eosinophils.
Oral management implications

- Before, during, and after chemotherapy, the dental hygienist plays a key role in helping patients/clients with malignancy understand that optimal oral hygiene care prevents or reduces oral complications. Such care improves patients/clients’ quality of life and the likelihood they will be able to tolerate ideal doses of cancer treatment.

- The best time for dental hygiene assessment for a cancer patient/client is before cancer therapy begins — in most circumstances, ideally a month before chemo begins. Particular emphasis should be placed on the identification and treatment of low-grade and acute oral infections. The dental hygienist should also ensure identification and elimination of sources of oral trauma and irritation, such as orthodontic bands, ill-fitting dentures, and other oral appliances. (In order to allow for healing, oral surgical/invasive procedures should ideally be performed at least 7 to 10 days before myelosuppressive therapy begins.)

- Oral infections such as periodontal, pulpal, and pericoronar disease can significantly increase the risk of sepsis if they are not treated before chemo begins. Therefore, preventive and therapeutic dental hygiene procedures (including tooth scaling) should ideally be undertaken before the patient/client commences chemotherapy.

- Teeth that have a poor lifelong prognosis, acute infection, or severe periodontal disease that may predispose the patient/client to complications (e.g., sepsis) should be extracted at least 5 to 7 days (in maxilla) or at least 7 to 10 days (in mandible) before the initiation of chemotherapy.

- Dental hygiene provision should be coordinated with the patient/client’s oncology team. Outpatient chemo requires dental hygiene treatment to be provided at appropriate times between cycles.

- While some cancer centres recommend discontinuation of toothbrushing and flossing during severe myelosuppression, this practice is controversial, because the decrease in plaque biofilm and local infection accomplished by brushing/flossing reduces the risk of sepsis.

- Tobacco and alcohol avoidance should be promoted. Dietary counseling should include emphasis on the need to avoid foods that irritate sore tissues or cause dental decay.

- When platelet levels are low (i.e., thrombocytopenia), the patient/client should be warned that improper toothbrushing or poorly fitting dental prostheses might cause bleeding.

- Patients/clients who complain of dry mouth during chemotherapy require at least a daily fluoride rinse and possibly 1.1% sodium fluoride toothpaste or gel.

- Candidiasis should be managed with topical oral antifungal drugs.

- The dental hygienist should be alert for signs/symptoms of oral bacterial infection (e.g., swelling, erythema, and fever) and ensure dental/medical referral for definitive diagnosis and treatment. Non-healing oral ulcerations should be considered such a reason, because immunosuppressed patients/clients undergo a shift in the oral flora to gram-negative bacteria that normally reside in the gastrointestinal or respiratory tracts, with oral ulcerations a common manifestation.

- Ulcerative oral mucositis occurs in 40% of patients/clients receiving chemotherapy, and in about half of these persons medical intervention is required, including modification of their cytotoxic cancer regimen.

- Mucositis management is very important, because mucositis is often a dose-limiting factor for chemotherapy. In addition to xerostomia management measures, mucositis can be addressed by extra-soft, nonabrasive toothbrushes and avoidance of commercial toothpastes with strong flavouring agents (and possible substitution with baking soda paste). All mouthwashes with alcohol or phenol should be avoided due to their irritating and drying effects. If toothbrushing becomes impossible due to painful tissues, the teeth, gingiva and tongue may be swabbed with gauze that has been moistened in warm water. Flossing should be continued as long as possible and recommenced as soon as the mucositis ends. Chlorhexidine 0.12% rinses may be used. While topical anaesthetic agents (e.g., viscous lidocaine 0.5%) and/or antihistamine solution (e.g., benzydamine HCl) may provide temporary relief from pain, patients/clients (particularly children and their parents) should be cautioned that there is a risk of food aspiration if the soft palate and epiglottis are anaesthetized; excessive use may actually increase mucositis symptoms. Some patients/clients may require systemic analgesics and even narcotics to control their mucositis pain.

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3 potentially life threatening illness caused by body’s response to infection, whose signs/symptoms include fever, increased heart rate, increased respiratory rate, and confusion

4 Features of infection may be attenuated or even absent in patients/clients with low white blood cell (WBC) counts due to chemotherapy.
Disease/Medical Condition

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Oral management implications (cont’d)

- Swishing ice chips in the mouth for 30 minutes, beginning 5 minutes before the patient/client receives the chemo drug fluorouracil (e.g., for colorectal cancer), may help prevent or reduce mucositis.
- Pain resulting from neurotoxicity can be alleviated with analgesics or other forms of systemic pain relief.
- In cancer patients/clients receiving high-dose chemo that results in thrombocytopenia, vigorous teeth brushing should be avoided, along with dental floss, water-irrigating appliances, and toothpicks. Softer devices (e.g., gauze wrapped around a finger and dampened with warm water or an appropriate antimicrobial solution) are indicated.
- Patients/clients with dentures should be evaluated frequently, because oral tissues may change significantly during chemo due to edema, ulceration, inflammation, and/or weight loss.
- Because patients/clients receiving chemo may have aversions to certain foods and odours, the dental hygienist should avoid use of scented body care products.
- Damage to tooth enamel from chemo-associated vomiting can be reduced with baking soda rinses post-emesis.
- The dental hygienist should be sensitive to the evolving psychological state of the patient/client who is diagnosed with cancer, about to undergo cancer treatment, or is recuperating from cancer treatment. Additional time may be required during the dental hygiene appointment for the patient/client to express feelings, as well as for situational oral hygiene instruction.
- Stress-related temporomandibular dysfunction pain can be managed with physical therapy (e.g., moist heat applications, massage, and gentle stretching) as well as judicious use of muscle relaxants or anxiety-reducing medications.
- A regular dental/dental hygiene recall schedule can be resumed when chemotherapy is completed and all side effects, including immunosuppression, have resolved.

Oral manifestations

- Oral complications occur in 40% of patients/clients receiving primary chemotherapy for any malignancy. They depend on the type of chemo drugs, dosages, and associated use of radiation. Patients/clients at relatively low risk are those receiving non-myelosuppressive or mildly myelosuppressive (bone marrow suppressive) chemo. Persons at higher risk are those receiving cytotoxic chemo accompanied by prolonged myelosuppression, with attendant immunosuppression and thrombocytopenia.
- Oral mucositis, sore gums, erythema, dysgeusia (altered taste, often unpleasant), neurotoxicity, infection, bleeding, xerostomia (and other salivary gland dysfunction), dental caries, tooth demineralization, and altered tooth development are potential complications throughout the entire period of chemotherapy administration, but, for the most part, resolve when chemo ceases. Burning, swelling, and/or peeling tongue may also occur. Neurotoxicity and bleeding from thrombocytopenia are treatment-specific to chemotherapy in contradistinction to localized radiation therapy.
- Mucositis usually occurs between days 5 and 14 after cytotoxic chemotherapy (particularly methotrexate and etoposide) administration5, when the drug results in a very low WBC count. Edema, inflammation, and ulcerations develop. The mucosal ulcerations begin as red, swollen tissue that later evolves into yellowish membrane-covered ulcerated tissue with epithelial sloughing. Younger cancer patients/clients (with higher cell division rates) are at elevated risk of chemo-induced mucositis. In the absence of secondary infection, the ulcerated tissue usually heals within 2-4 weeks after completion of treatment. Patients/clients with mucositis complain of pain, burning, dysphagia, loss of taste, and general oral discomfort, which can interfere with chewing, swallowing, talking, and obtaining good nutrition. Oral infections tend to intensify mucositis.

5 Other chemotherapy drugs associated with damage to oral mucosa include doxorubicin, fluorouracil, busulfan, bleomycin, platinum coordination complexes (including cisplatin and carboplatin, and mammalian target of rapamycin (mTOR) inhibitors (a new class of targeted cancer therapeutic agents).
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Oral manifestations (cont’d)

- The labial mucosa, buccal mucosa, tongue, floor of mouth, and soft palate (with higher rates of epithelial cell turnover) are more severely affected by chemotherapy than are the heavily keratinized tissues such as the hard palate and gingiva.
- Oral mucosal toxicity may be worsened by the use of concurrent head and neck radiation with chemotherapy.
- Immunosuppression results from chemo agents that suppress the bone marrow. The patient/client is at risk — exacerbated if there is concurrent xerostomia and salivary gland dysfunction — for chronic oral infections, including fungal infections such as candidiasis, as well as viral (e.g., herpes simplex, varicella zoster, and cytomegalovirus) and bacterial infections. Infections may affect the mucosa, dentition/periapices, and periodontium. After intensive chemotherapy, full recovery may take several months.
- Neurotoxicity can result from chemotherapeutic agents derived from plant alkaloids (e.g., vincristine and vinblastine), resulting in severe odontogenic-like pain (persistent, deep aching and burning in character) that mimics pulpitis. It is most frequent in the molar region and can be bilateral. Additionally, drugs such as lenalidomide and thalidomide (used for the treatment of multiple myeloma) are associated with peripheral neuropathies that can affect the face and jaw. Pain resulting from neurotoxicity ceases within a week of discontinuing the causative chemotherapy.
- Dental hypersensitivity may occasionally arise in patients/clients weeks or months after discontinuation of chemotherapy.
- Chemo agents that cause myelosuppression may result in thrombocytopenia and consequently bleeding problems. Gingival bleeding and submucosal hemorrhage can occur as a result of minor trauma (such as tongue biting or toothbrushing) when the platelet count falls below 50,000 cells/mm$^3$, and spontaneous gingival bleeding may occur with a platelet count < 20,000/mm$^3$. Palatal petechiae and purpura along the lateral margin of the tongue are other manifestations of thrombocytopenia.
- Tooth root development may be altered when some chemo drugs are given before age 10 years.
- Chemotherapy is the use of drugs (often in combination) to slow or stop the growth of fast growing cells, such as cancer cells. It may be used by itself to cure/control/palliate certain cancers or in combination radiation therapy. Most chemo complications result from myelosuppression and direct cytotoxic effects. High doses of chemotherapy over a short time (as used to treat, for example, some types of chronic leukemia in adults) are called induction chemotherapy; this form of therapy results in many unpleasant side effects. After induction chemo, once remission has started, low-dose chemo over a longer period of time (know as maintenance chemotherapy) is the treatment protocol for some cancers (such as certain leukemias).
- Acute toxic reactions occur during and immediately after chemotherapy. These include breakdown of mucous membranes, depression of the bone marrow (infection, bleeding, anemia), alopecia, and gastrointestinal changes (diarrhea, nausea, vomiting, malabsorption). Some chemo drugs also induce heart and lung dysfunction.
- Dehydration and malnutrition can result from chemo-related vomiting, diarrhea, gastrointestinal tract damage, and/or being unable to drink due to mouth pain.
- Infection as a result of myelosuppression is the most common serious complication of chemotherapy. Bacterial, fungal, and viral infections affect both local and distant body sites, and they can lead to sepsis and death. In myelosuppressed patients/clients, the oral cavity can be a source of systemic infection.

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6 Petechiae and purpura are red or purple spots on the mucosa or skin, which do not blanch to applied pressure, caused by extravasation of blood (i.e., hemorrhages). Petechiae are pinpoint to pinhead in size (i.e., 1 to < 3 mm in diameter), whereas purpura lesions range from 3 to 10 mm in diameter.

7 Myelosuppression is the reduction of the bone marrow’s ability to produce cells. This includes decreases in the production of cells responsible for providing immunity (leukocytes, or white blood cells), carrying oxygen (erythrocytes, or red blood cells), and/or those responsible for normal blood clotting (thrombocytes, or platelets).
Related signs and symptoms

- The following signs/symptoms in a patient/client undergoing chemotherapy should prompt emergency/urgent medical consultation:
  - a fever of 38.0°C or greater (oral temperature);
  - intense chills;
  - a rash or potential allergic reaction, such as swelling of the mouth or throat, severe itching, trouble breathing or swallowing;
  - bleeding or unexplained bruising;
  - pain at the chemo injection site or catheter site;
  - unusual pain, including intense headaches;
  - shortness of breath or trouble breathing;
  - long-lasting diarrhea or vomiting; or
  - bloody stool or urine.

- Anxiety and depression often occur in cancer patients/clients undergoing chemotherapy, exacerbated by oral complications that affect eating and speaking. Social withdrawal may occur, and some drugs used to treat depression cannot be used because they worsen oral side effects. Fatigue is also common.

- Some types of chemotherapy cause long-term complications (“delayed toxicity”), such as heart, lung, bladder and/or kidney damage; peripheral neuropathy; and fertility problems. Second malignancies (including cancers of the oral cavity) may arise many years later. However, many patients/clients have no long-term problems.

References and sources of more detailed information


- National Cancer Institute, National Institutes of Health: Oral Complications of Chemotherapy and Head/Neck Radiation (PDQ®)
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References and sources of more detailed information (cont’d)

- Oral Complications and Social Problems
- Oral Complications of Chemotherapy and Radiation Therapy in Children
- National Institute of Dental and Craniofacial Research, National Institutes of Health
  - Oral Complications of Cancer Treatment: What the Oncology Team Can Do
    http://www.nidcr.nih.gov/oralhealth/Topics/CancerTreatment/Documents/OncologyTeamCanDo.pdf
  - Oncology Pocket Guide to Oral Health
  - Dental Provider’s Oncology Pocket Guide
    http://www.nidcr.nih.gov/oralhealth/Topics/CancerTreatment/ReferenceGuideforOncologyPatients.htm
  - Chemotherapy and Your Mouth
    http://www.nidcr.nih.gov/oralhealth/Topics/CancerTreatment/ChemotherapyYourMouth.htm
- HealthLinkBC, citing National Cancer Institute, National Institutes of Health: Oral Complications of Chemotherapy and Head/Neck Radiation (PDQ®): Supportive Care — Health Professional Information
  http://www.healthlinkbc.ca/healthtopics/content.asp?hwid=ncicdr0000062870
- American Cancer Society
  http://www.cancer.org/treatment/treatmentsandsideeffects/treatmenttypes/chemotherapy/understandingchemotherapyaguideforpatientsandfamilies/understanding-chemotherapy-chemo-side-effects

* Includes oral hygiene instruction, fitting a mouth guard, taking an impression, etc.
** Ontario Regulation 501/07 made under the Dental Hygiene Act, 1991. Invasive dental hygiene procedures are scaling teeth and root planing, including curetting surrounding tissue.

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