Special Article

Oral Health Care in Head and Neck Cancer

Sirikarn Sutthavong DDS, MPH*,
Pornchai Jansisyanont DDS, MSc**, Narisa Boonyopastham DDS, MSc*

** Dental Department, Phramongkutklao Hospital, Bangkok 10400 Thailand*
*** Department of Maxillofacial and Oral Surgery, Chulalongkorn University, Bangkok 10400 Thailand*

The oral assessments and oral care prior to cancer treatment are important to eliminate predisposing factors of oral complications from cancer therapy. Meticulous maintenance of oral hygiene and topical fluoride application are essential in the prevention and management of oral complications. Palliative and conservative treatments are the treatment of choice for oral complications. Periodically oral assessments and care should be performed after cancer treatment for the early detection and interventions of any treatment complications.

Keywords: *Oral health care, Head and neck cancer*

J Med Assoc Thai 2005; 88(Suppl 3): S339-53
Full text. e-Journal: *http://www.medassocthai.org/journal*

Managements of head and neck cancers usually are the conventional treatment modalities which consist of surgery, radiation, chemotherapy or a combination of these. Cases in which radiotherapy and/or chemotherapy or both are planned for curative or palliative treatment, each treatment has specific early and late effects depending on the dose and host susceptible. Chemotherapy causes myelosuppression, immunosuppression or direct cytotoxic effects which may manifest as mucositis, soft tissue ulceration, increased infections and bleeding. Radiation may not only kill cancer cells but also damage the surrounding tissues and render many side effects such as mucositis, dermatitis, loss of taste and xerostomia and some that will not show until many years later after radiotherapy such as osteoradionecrosis, trismus and extensive dental caries[1,2]. The oral complications are common of head and neck cancer treatment. As the consequences could affect the effectiveness of cancer therapy as they may interrupt and halt the course of treatment. Besides, the quality of life of the patients will dramatically change from the deleterious pain and some of those may last life long[3].

Oral assessment and dental care have been highly recommended before cancer therapy to eradicate all potential sources of oral infections and trauma which may cause complications during and after treatment of cancer. It has been shown that there was an association between poor oral hygiene, poor dental status and oral cancer[4]. Most of the patients with head and neck cancer usually have noncompliant with routine dental care and 95% need oral care before cancer treatment[1, 5, 6, 7]. The oral evaluation and care should be continued

Corespondence to: Sutthavong S, Dental Department, Phramongkutklao Hospital, Bangkok 10400, Thailand. E-mail address: oisiri@yahoo.com

throughout the treatment with highly cooperation from the patients especially the continuous self meticulous oral hygiene, after and through the rest of their life. The patients must achieve a good level of oral hygiene before the beginning of cancer treatment[1, 8, 9]. They must be informed and understand the rationale of the oral hygiene program as well as the potential effects of radiation therapy and chemotherapy.

This review is to assess the appropriate prevention and oral care in head and neck cancer patients to provide the oral comfort and function for improving the patients' quality of life.

Oral health prevention programs prior to head and neck cancer therapy

The severity of oral complications from cancer treatment can be reduced significantly when an aggressive approach to stabilize oral care is initiated prior to the beginning of cancer treatment[5,10]. Ideally, the oral assessment should be performed at least a month before the beginning of cancer treatment to provide enough time for the adequate healing, especially when invasive dental treatment such as tooth extraction and alveolectomy are performed[10]. The oral examination must include the radiographic examination for both dentate and edentate patients, panoramic, selected periapicals and bitewings are recommended[11]. A careful assessment of existing dental and periodontal diseases and complete dental and periodontal charting should be done to set up the baseline information. Dental prosthesis should be carefully evaluated as well as the condition of oral soft tissues and saliva flow of the patients[12].

Oral self-care includes frequent tooth-brushing with a soft bristled toothbrush, ideally one should brush after meals and before bedtime. Floss between proximal of the teeth at least once a day. The assessment of the patients self awareness of their dental health, their motivation and ability to perform oral hygiene procedures is recommended[12].

Adequate intake of protein rich diet is recommended before cancer therapy, however the care of refined carbohydrates and sugar intake which can lead to dental caries should be seriously considered. The patients who have multiple teeth extraction before radiotherapy may have pain and chewing difficulty. The counseling of diet modification may be necessary for prevention of weight loss. Patients's weight and nutritional input should be assessed at the beginning of treatment and regularly weekly throughout cancer treatment[13].

The use of topical fluoride is essential since fluoride can reduce dental caries, and must be continued throughout and after the treatment. Application of 1% sodium fluoride gel or 0.4% stannous fluoride to the teeth surface with custom built fluoride tray provided for each patient once or twice per day is recommended. Brush on fluoride gel or high concentration fluoride dentrifices can be done[7,10]. In children both topical and systemic fluoride are recommended[10].

Prophylactic mouth rinses of chlorhexidine and fluoride are recommended. It has been suggested that chlorhexidine may reduce oral mutans streptococci, and lactobacilli in the mouth[14]. Using either chlorhexidine mouthwash or dental gel twice daily for at least one week prior to commencing cancer treatment will contribute the treatment of gingival disease in combination with improved oral hygiene practices. Furthermore, some reports showed reduction of the incidence of oral complications from cancer treatments[15].

Dental treatment before cancer treatment

Teeth should be cleaned by dental prophylaxis, full mouth scaling and polishing. All the dental caries and periodontal diseases should be treated; tooth restorations should be done to an

acceptable level. Irritating factors in the mouth such as sharp edge teeth, rough filling, overhang filling should be smoothed or polished. All broken or leakage fillings should be repaired and replaced. Ill-fitting or broken dentures should be adjusted and repaired, to avoid trauma to the ridges. All fixed prostheses including implants should be in good retained and hygienic conditions. Instruction of brushing, flossing, cleaning dentures and implants should be reviewed[8,16,17].

Knowledge of radiation dose, modality of treatment, field of radiation and tumor prognosis are important roles in the dental treatment plan[12]. The more aggressive dental managements should be performed for patients with poor oral hygiene, noncompliance or limited previous dental care and those who have evidence of past periodontal diseases. The criteria used for extractions before radiotherapy or prophylactic extraction are not universally accepted and are subject to clinical experience and judgement of the dental team[11,16]. It is recommended that teeth in the high-dose radiation field with a questionable prognosis should be considered for extraction, non-restorable caries, periodontitis with the furcation involvement, pocket of 5 mm or more, retained root, non-opposed tooth and compromised hygiene, partial impaction or partially eruption tooth, teeth with extensive periapical lesions should be extracted. All teeth in direct association with an intraoral tumor should be removed[11,17,18,19]. Dental implants with poor maintenance of peri-implants health should be removed[12].

In children all primary teeth with any risk of pulpal involvement and those which will exfoliate within 3 months should be removed, a partially erupted tooth is to be extracted. The use of sealants is recommended on all exposed tooth surfaces. If the tooth extraction is unavoidable antibiotics coverage before and after extraction is suggested. Atraumatic approaches and good surgical techniques should be done for the extraction. The bone at the wound margin and sharpened bone spicules should be trimmed evenly. Alveolectomy should be performed to ensure smooth alveolar ridge and prepare for construction of denture after cancer treatment. It is recommended that optimal post surgical time prior radiotherapy should be within 2 to 3 weeks[17, 19, 20].

If the patient demonstrates a history of good oral hygiene care and compliancy with routine and ongoing professional dental visit, their questionable and asymptomatic teeth such as chronically involved root furcation without mobility or any acute infection are not subjected to extraction[19]. Complete bony impaction can be left as well as teeth with non symptomatic periapical lesions and well localized[11, 21].

Endodontic treatment is usually recommended for pulpal involved teeth with proper performance. Periodontal surgery should be avoided because of prolonged healing and meticulous oral hygiene is necessary for the good result[12]. Crown and bridges that showed the image resolution interference from metal density in CT scan should be replaced with plastic temporary crowns during radiation. Orthodontic appliances should be removed and the treatment paused for 1 year after the completion of cancer therapy[7, 10].

Saliva flow should also be assessed as the base line evaluation. The average person produces at least 500 ml of saliva per day, salivary flow rates vary depending on the demand or the current physiologic status of patients, the non-stimulated or resting flow rate is 0.3 ml/min, and flow rate during sleep is 0.1 ml/min, during eating or chewing increases to 4.0 to 5.0 ml/min[22]. The measurement of maximum mouth opening should also be evaluated for base line measurement before radiotherapy, and frequent measurement should be performed to ensure the maintenance of maximum mouth opening[16].

Oral health prevention and management programs during cancer therapy

Mucositis is a common side effect of anticancer therapies. Approximately 95-100% of radiotherapy patients[8,23], and 77% of chemotherapy patients[24] develop mucositis. Oral mucositis is characterized by mucosal erythematous, erosive and ulcerative lesions which may be covered by a white pseudomembrane[8]. Mucositis are usually painful and cause discomfort which compromises nutritional intake as well as communication and sleep. The serious concern is increasing the risk of infections while the patients are immuno-compromised. The risk of septicemia is much higher in neutropenic patients with oral mucositis than those without mucositis[5,8,23]. Mucositis from chemotherapy usually begins 3 to 5 days after initiation of chemotherapy and peaks at 7-14 days. Without infection mucositis will spontaneously heal within 2 to 4 weeks[3,7,10]. Mucositis caused by radiotherapy depends on the cumulative tissue dose usually begins at the dose about 15 Gy to 20 Gy of standard or conventional fractioned radiation therapy which has the average dosage of 200 rads or 2 Gy per fraction, one fraction daily for 5 days a week[19, 25]. Around the second week of radiation ulcerative mucositis appears and lasts for 6 to 8 weeks depending on the duration of treatment[26]. Spontaneous healing can be anticipated within 3 weeks after radiation. Delayed healing of mucositis is caused by high dose radiotherapy and smoking tobacco[7].

The main objectives for prevention and treatment mucositis are elimination of mucosal-irritating factors, maintenance of good oral hygiene, prevention and treatment of infections including symptomatic treatment of lips and oral cavity such as dryness, mucosal pain and inflammation. It is recommended that managements of oral mucositis are palliative and conservative treatments[5,7,16,26].

Maintenance of oral hygiene is the most important measure for the prevention of oral mucositis which can reduce the incidence and severity by decreasing the breakdown of the mucosa and promotion of the mucosa healing[5,27]. Plaque accumulation and gingivitis may cause more problems than the risk of hemorrhage from toothbrushing and flossing. The patients should be encouraged to keep their mouths very clean as long as oral self care remains atraumatic. Regular tooth-brushing and flossing without gingival trauma should be continued unless contraindicated by neutropenia and thrombocytopenia. In these cases the use of an ultra soft toothbrush or toothette (sponge on stick) is recommended. Besides, a toothette may be used for cleaning the alveolar ridge, palate and tongue[8,10]. Mild flavored toothpastes with fluoride are recommended since strong flavored toothpastes may irritate the mucosa of the mouth. Patients should be encouraged to brush with saline if the toothpaste irritates[14]. It is recommended to wipe the teeth gently with a wet gauze soaked saline to remove food particles or use a cotton bud or gauze soaked aqueous base chlorhexidine swab on the oral tissues when it is too painful for brushing[8,10]. However, the use of cotton buds, wiping gauze or toothettes cannot remove dental plaque adequately, routine oral hygiene care by brushing and flossing should be resumed as soon as possible when the pain has subsided.

The patients should be encouraged to rinse their mouths frequently since rinsing helps to remove particles and bacteria from the mouth and prevents crusting of sores in the mouth. Repeat gargle with saline or sodium bicarbonate solution is suggested every 2 to 4 hours as needed for pain[24]. During mucositis the use of a mouthwash containing alcohol, hydrogen peroxide and some acidic non prescription oral preparations for preventive oral hygiene is not recommended since they can cause erosion and tooth sensitivity or damage the mucosa and delay wound healing. The use of chlohexidine

remains controversial in mucositis. The potential benefits of prophylactic rinsing with chlohexidine are to control plaque levels, gingivitis, reduce caries risk, and oropharyngeal candidiasis rather than any effect on oral mucositis[10,11,26].

Drinking water in high volume is recommended to maintain the moistness of the tissue and the body fluid balance[7]. The patients should avoid certain foods that may cause mucosal irritation or damage fragile mucosa including sharp, hard, abrasive, salty, spices and acidic food. Alcohol, tobacco, acidic fruit and hot drinks may irritate the oral mucosa. Coffee and tea which are diuretics may worsen the dry mouth. Acidic juices, soda or carbonated fizzy drinks should be avoided since the low pH of these drinks may contribute to tooth sensitivity and irritate the oral mucosa[26, 27,28].

Removable dentures should be limited only at just meal times and cleaned after eating. The appliances should be left out when sleeping and discontinued if causing trauma to the mucosa, and during ulcerative mucositis. When dentures are not worn, they should be soaked in antimicrobial solutions[10].

Pain managements during mucositis include topical and systemic analgesics, anti-inflammations have been used for the prophylaxis and reduce the severity of mucositis in head and neck radiated patients[7,10]. Opioid drugs may be used for control of pain. NSAIDS, aspirin-type analgesics should be avoided because of bleeding risk in chemotherapy induced mucositis[10]. Topical anesthetic agents may give symptomatic relief of pain.

It is recommended to use mucosal coating agents like kaolin with pectin suspension, mixture of aluminum or magnesia hydroxide suspensions and many antacids or cellulose film-forming agents for covering localized ulcerative lesions. Hydroxypropyl methylcellulose combined with topical anesthesia are used effectively for relief of pain. Lanolin-based cream and ointments may be more effective in protecting against trauma. Lip care products containing petroleum-based oils and wax can be used for preventing dryness of the lips and reduce the risk of tissue injury in chemotherapy patients[10]. However, during radiation oral hydration and lubrication by using a water spray or saliva substitute and a non petroleum lip balm for dryness of the lips[27]. Mouth breathing and xerostomia may worsen the dryness of the lips[10].

Cryotherapy is useful in prevention of mucositis associated with short half life stomatotoxic, 5-FU. Patients are instructed to swish ice chips in their mouth for 30 minutes, beginning 5 minutes before the administration of intravenous infusion. Ice chips producing local vasoconstriction and decreasing blood flow to the oral mucosa during the peak serum concentrations helps reducing chemotherapeutic drug exposure and also the risk of mucositis[28].

Many agents and protocols have been promoted for management or prevention of mucositis. The use of a combination of drugs and supportive treatments has had some degree of success with mild and moderate mucositis pain, but provide little relief for severe mucositis, and overall the prevention and management of oral mucositis remains unsatisfactory and basically unpreventable because of not being adequately supported by randomized controlled clinical trials[29].

Hyposalivation or xerostomia is the acute effect of radiation. Parotids glands are at high risk to radiation damage[7,30]. After low dose 10-15 Gy it has been found there can be a serious loss of function of the parotid gland. During the first week of radiation saliva may decrease by 50% to 60% with basal salivary flow reaching a measurable minimum by 2 to 3 weeks after 23 Gy of fractionated RT[31]. With high dose 60-70 Gy there is a rapid decrease of salivary flow during the first week up to 90%, by 5 weeks of treatment the

salivary flow has nearly ceased and rarely recovers[7]. Damage to the salivary gland can have a remarkable effect on the patients' oral health and quality of life since many consequences may follow such as mucositis, oral pain and discomfort, difficulty with mastication, deglutition and articulation, dysguesia, aguesia, speaking, soft tissue breakdown, bone loss and chronic infections especially the risk of dental caries and oral candidiasis are increased[32,33]. Symptoms and signs of xerostomia include dryness, burning sensation of the tongue, fissures at lip commissures, atrophy of dorsal tongue surface and increased thirst. Xerostomia is not a life threatening side effect, but it is usually irreversible[31].

The oral care for xerostomia is to minimize the risk of caries, and provide moisture to the lips and mouth. Plaque and food debris easily accumulate due to the loss of saliva flushing action. Frequent care of oral hygiene is necessary. Only rinsing the oral cavity may not be sufficient for thorough cleansing of the oral tissues. It is necessary to use a mechanical plaque removal by tooth brushing, flossing and other oral hygiene aids after meals and before bed time. Water irrigation (Water-Pik) may be used to help clean the teeth. Saline and baking soda rinse help to buffer the oral environment as well as topical fluoride which helps to remineralize the teeth[10, 34].

Temporary relief of dryness and the treatment of dry mouth usually focus on palliative measures with saliva substitutes for the lubrication, hydration of the oral tissues and for maintaining oral health and functions. Saliva substitutes usually lack protective roles as natural saliva, and their duration effect is often shortened by swallowing and moreover oily consistency and sticky feeling are poorly tolerated. However, recent studies have indicated that there are bio-active dry mouth products containing antimicrobial peptides to protect the oral tissues against microbial colonization and to cure mucosal and gingival inflammation[35]. Frequently sipping water during the day is suggested to relieve dry mouth. Ice cubes or iced water may be used to keep the mouth cool and moist[11,23,34]. Often applying lip moisturizing prevents dryness and cracked lips.

Stimulation of the remaining salivary gland tissues by systemic sialogogues help stimulate saliva production from the remaining functional salivary glands. The use of pilocarpine or cevimeline have shown promising effects in increasing saliva flow in patients undergoing radiotherapy. However, there are contraindications and adverse effects of pilocarpine which should be carefully considered before prescribing to the patients[23,34,36]. Sugar-free chewing gum and sugar-free candies or lozenges may help to increase salivary output but they may be inconvenient and affect the patients'compliance in those who wear dentures[11,22].

The use of pharmacologic prevention and management of radiation-induced xerostomia, amifostine intravenous 15 to 30 minutes before each fraction of radiotherapy is found decreasing the severity of radiation-induced xerostomia[34,37,38]. It has been demonstrated that the quality of life in patients receiving amifostine has been improved such as improving speech, eating, sleep and overall well-being[39]. Reduction of severe hematologic and high grade mucositis were reported to with high doses of aminofostine, intravenously during chemotherapy[40]. The administration of pilocarpine before or during radiation and the beneficial effect to lessen the frequency and severity of xerostomia from radiation-induced remain controversial[36,41].

Several investigation interventions have been demonstrated for the treatment of cancer for preserving the normal tissues and less toxicity, some reports showed potential effect such as: the use of intensity modulated radiotherapy (IMRT) for preserved salivary gland function especially parotid glands[42]. Salivary gland transfer technique transfers submandibular gland to submental space in patients

undergoing radiotherapy for preserving salivary function since the submental region is regularly shielded when radiated[13,32], and during gene therapy[43]. However, furthermore clinical controlled trial studies should be continued.

Dysguesia or taste dysfunction results from damage of taste receptors which usually occurs by the first week of radiotherapy and becomes worse from the second week throughout the entire cycle of radiation, increasing relatively to accumulate dose of radiation. The loss of taste usually involves all 4 tastes sweet, sour, bitter and salty[44]. Partial improvement can be observed between 3 to 10 weeks after radiotherapy and fully recovery within 4 months. However, some authors reported an increase in taste thresholds up to 1 year or more. Zinc sulphate may be used for preventing, and/or reducing the radiation induced taste alterations. The use of zinc sulphate supplements 2 or 3 times a day may help with recovery of the sense of taste[10,44].

Dysphagia is a common, debilitating and potentially life threatening sequel of chemotherapy and radiotherapy for head and neck. During mucositis and pain dysphagia may be more severe which may lead to malnutrition, dehydration and other consequences. Inhibition of deglutition reflex, the patients develop difficulty in swallowing solid foods or liquids. 45% develop severe dysphagia require prolonged tube feedings for more than 3 months or repeated dilatations. Depressed cough reflex may cause aspiration in patients which may lead to aspiration pneumonia. The post surgery complications, location of cancer and xerostomia can affect speech and swallowing[10,27,45].

Providing adequate oral nutrition and maintain safety when eating and drinking is essential during dysphagia . For preventing malnutrition and prolonging life enteral feeding should be initiated when the patients loose weight more than 5 kg or consume less than 50% of daily nutritional requirements[13]. Dietary modifications are recommended to ease swallowing for the patients vary according to the level and severity of dysphagia[28]. During xerostomia, the recommended diet is moist and soft. Dry and salty food and some medications prescribed for comobid disease can worsen dry mouth[14, 44].

Oral infections may be seen during and after cancer therapy. It is more common and more severe in chemotherapy treated patients than in irradiated patients[12]. Infections can occur during mucositis and disseminate systemically from the ulceration and inflammation of mucosal. The reduction of salivary flow due to destruction of salivary glands from radiation is the important factor that increases the risk of oral infections. Reduced salivary flow causes the loss of mechanical oral flushing, decreases production of electrolyte, immunoglobulin, lysozymes and peroxidases, loss of saliva buffering capacity and lower of saliva pH[7, 34].

In patients who undergo radiotherapy, the most common infections are fungal infections such as *Candida* spp. Candidiasis commonly manifests as pseudomembranous, hyperplastic, or atrophic (erythematous) oral lesions and angular cheilitis. Oral candidiasis occasionally can be invasive, resistant to treatment, and potentially lethal. In children with chemotherapy systemic candidiasis can become a medical emergency[12]. Systemic azole antifungals are effective in reducing overall oral fungal colonization levels and the frequency of fungal infections. Fluconazole is recommended as the drug of choice for antifungal especially in resistant fungal infections. If patients are wearing dentures topical miconazole or vanish applied to the inner surface of denture should be done[46].

Streptococci mutans and *Lactobacilli* infection are increased in the radiotherapy patients due to the lost of saliva protective and buffer actions[7,34]. In myelosuppressed cancer patients, systemic infections of gram-positive organisms

including *Streptococci viridans* and *Enterococci* spp. are usually from oral origin. Radiotherapy is also associated with a noticeable increase in oral gram-negative pathogens including *Pseudomonas aeruginosa, Neisseria* spp. and *Escherichia coli* the endotoxins of which can cause adverse systemic effects[7,10,12]. Signs of gingivitis may be seen due to the underlying myelosuppression. Myeloablated cancer patients with chronic periodontal disease may develop acute periodontal infections with associated systemic sequelae. Extensive ulceration of sulcus epithelium can act as a portal of entry of translocation of microorganisms into the bloodstream[47, 48]. Prophylactic antimicrobials can be used to prevent dental caries and oral infections, aqueous based of chlorhexidine mouth rinses have been demonstrated to be beneficial[34, 49].

Herpes simplex virus (HSV) and Herpes varicella zoster virus (VZV) are the main symptomatic viral infections affecting the mouth of cancer patients. However, cases of Cytomegalovirus induced ulceration have been occasionally reported[50, 51]. In chemotherapy children, acute herpetic gingivostomatitis with systemic involvement is considered as a medical emergency[12]. Acyclovir is the most useful antiviral agent for HSV and VZV infection. Valacyclovir can reduce the incidence of oral HSV infections[52, 53].

Dental Treatment during cancer therapy

Dental treatment during radiation should be avoided. Occasionally when there is an emergency, palliative treatment such as temporary dressing is recommended. Definite dental treatments and removal of teeth during radiation should be delayed until radiotherapy finishes and the mouth has healed from mucositis and dermatitis reaction[20, 54]. In chemotherapy patients, routine dental treatment may be performed as usual if the granulocyte count is more than 2,000 mm^3 and the platelet count is more than 40,000 mm^3. It is recommended that dental care should be performed the day before chemotherapy[12,55]. Supragingival prophylaxis can be performed[28]. Tooth extraction during chemotherapy is contraindicated. If an emergency is needed for the patients with low white blood count and platelet count, all dental procedures should be carefully performed without trauma to the soft tissues, antibiotics prophylacxis should be administered under supervision of the oncologist[12]. Symptomatic treatment should be performed such as pulpectomies and temporary fillings, therefore, the teeth may be reopened for relief pain when needed until extraction is allowed. Platelet infusion may be needed in patients who undergo invasive dental procedures. Topical therapy using pressure and splints may be required to control hemorrhage[55].

Oral health prevention and management programs after cancer therapy

After cancer therapy the dentist should establish dental recall schedule for periodical check up for oral assessment and dental care. Frequent recall, every 3 months is necessary for encouragement of oral hygiene care and early detection of oral diseases in order to prevent dental caries progression to the possible pulpitis or periapical lesions and future risk of osteoradionecrosis[16]. Regular dental cleaning, scaling, polishing and fluoride treatment are essential as part of life-long preventive protocol and the assessment for oral complications should be continued[7,21].

After radiation, the patients may develop progressive jaw stiffness and limitation of mouth opening. It usually occurs when the mastication muscles and temporomandibular joint capsule are in the radiation field. Temporomandibular joint disorder (TMD) and trismus is a common complication which usually develops 3 to 6 months after radiation due to radiation induced hypovascularity and soft tissue fibrosis or scaring

from the surgery. Furthermore some authors suggested TMD may develop due to anxiety, depression or the stress associated with cancer or because of sleep disorder[56]. The limited opening of the mouth combined with xerostomia may cause difficulty to maintain oral hygiene, speech and eating.

For the prevention of trismus, the patients who have radiation should frequently practice mouth stretching excercises for range of motion of the jaw daily. Once limitation of mouth opening occurs it may irreversible. A strict regimen of mouth exercises is recommended to minimize the problems. The use of a simple wedge made by stacked tongue blades or the use of rubber stops to regain the mandibular opening[16]. Physical therapy such as massage, moist heat application and gentle stretching are recommended. Medications with muscle relaxants, anti-anxiety agents have been used to ease mouth opening[16,56].

Cancer therapy in children may also result in long term complications including enamel hypoplasia, microdontia, delay or failure of tooth development and eruption, altered root formation, as well as mal-development in the craniofacial skeleton that may affect the facial esthetics such as micrognathia[7]. The effect of a high dose of radiation to condylar cartilage of temporomandibulur joints (TMJ) may cause TMJ ankylosis and the consequences effect the growth and movement of the jaw. In children, orofacial complications are more severe than adults who have similar treatment[7,10].

Osteoradionecrosis (ORN) of the jaw is a severe complication of radiation therapy of head and neck cancer and expressed as a chronic non-healing wound followed by bone necrosis. A high radiation dose produces a significant hypovascular and hypocellular and causes tissue hypoxia and compromises the healing of bony tissues. The mandible is the most commonly effected[57, 58]. The incidence rate before 1988 varied from 3% to 44.2%[59, 60]. However, recently the researchs have shown a continuous decline in the incidence of ORN with modern radiation therapy technique[57, 61, 62] and the meticulous preventive oral hygiene measures and dental evaluation in the irradiated patients[63].

There are multiple factors associated with an increased incidence of ORN. It is known that the tumor location, size of radiation treatment field, dose per treatment, total radiation doses and combination interstitial implant and external beam regimen are associated with the occurrence of radiation related side effects[61, 64, 65]. The process of ORN may be spontaneous or result from induced trauma to the bone and soft tissues such as post-radiation extraction, surgical treatment in irradiated field shortly before or after radiation and surgical techniques[66,67]. The ill fitting dentures may also cause trauma to the gum and poor oral hygiene accelerates the infections in irradiated patients. Different tissues have various levels of tolerance of radiation damage[61]. Patients who have more risk of ORN are those with multimodality cancer therapies, compromised nutritional status, substances abuse such as tobacco and alcohol. The patients with comorbid disease and decreasing host immune response also affect the ability to repair tissue damage from radiation[61, 68].

Hyperbaric oxygen therapy (HBO) has been used to help the repair of radiation induced damage including mandibular ORN[61, 62, 68, 69]. Improving the oxygenation of tissues helps eradicate anaerobic bacteria and the high oxygen tension promote neovascularization in damaged tissue of irradiated patients[70]. HBO alone or in combination with surgery seems to be the gold standard for treatment and prevention of ORN in irradiated patients[71]. However, HBO has not been universally accepted as the only appropriate treatment of radiated patients and prevention of ORN where there is no

possible access both economics and availability[64]. It was reported that the majority of patients undergoing post radiation therapy dental extractions did not develop ORN. Sulaiman et al studied 1194 patients.There were 951 dental extraction in 187 patients before or after radiation (57.22% after radiation). 65.41% of extraction required no antibiotics and less than a quarter of the patients received antibiotics. 54.65% of dental extractions did not achieve primary closure, most extractions did not require mucoperiosteal flap (90.12%). Only 7 in 187 patients received HBO therapy as a prophylactic protocol. The incidence of ORN was 2%[19]. From the existing information, the guidelines for the dental management in the irradiated patient should consider the use of HBO before extractions as an adjunctive therapy but not as a standard of care[19]. The use of HBO should be considered in the following situations; there are poor trabecular patterns of bone in the surgical area, vascularization and density pattern are poorer when compared to the preradiation radiograph. Besides, HBO is recommended in patients with comorbid disease such as diabetes, hematologic profile or the extracted teeth are in the field of radiation.

Neurotoxicity and teeth hypersentivity are oral complications from radiotherapy. It is reported chemotherapy can cause direct neurotoxicity and related to leukemic infiltration of dental pulp tissue and direct jaw infiltration. The patients may have deep seated, throbbing mandibular pain and dental hypersensitivity may occasionally occur weeks or months after chemotherapy[10]. Soft-tissue pain can be found[34]. Management of neurotoxicity is supportive treatment for pain. Topical fluoride application and desensitizing toothpaste may improve the discomfort[10].

Dental caries is a consequence of radiation xerostomia caused by two mechanisms, first the loss of saliva defense mechanisms, second, radiation damage to the pulp of the teeth causes dry, brittle type of dentine which causes loss of enamel from the dentinoenamel junction[7,24] compound with the patients' inability to maintain the high standard of oral hygiene. Radiation caries are primary cervical location of the teeth, incisal edges and cusp tips are also at risk. Carious lesions can develop rapidly within 1 to 2 years and often found as devastating destruction of teeth with fracture of crown to gum level.

Dental treatment after radiation therapy and chemotherapy

Restorative considerations in management of carious teeth after radiation, should be simple and conservative that render the acceptable esthetics and functions. Ideally restoration materials used in the xerostomia patients should have fluoride release and cariostatic. Light-activated glass-ionomer seems to be suitable because the advantages of tooth adhesion, extension fluoride release and fluoride uptake in the dry oral environment as well as esthetics and greater resistance to acid attack and desiccation. On occlusal surface the use of conventional glass-ionomer cement and dental amalgam are recommended because fillings with composite resin have a higher risk of marginal leakage and recurrent caries underneath the restorations[17]. Full coverage crowns and splints are not suggested because cervical margins remain susceptible to recurrent caries, unless caries under control[17]. Endodontic treatment remains a practical treatment altenative for postradiotherapy patients if the pulp has been infected and the tooth is restorable. Carefully instrumentation must preclude pushing debris beyond the tooth apex, likewise, shorter endodontic fills are associated with less pathological response. Periapical radiolucencies may persist after successful endodontic therapy due to decrease alveolar vascularity and hypocellularity[55]. The risk of ORN from extraction is not the indication for endodontic treatment in poor prognosis cases.

There are several severe cases of ORN from an improper case selection of endodontic treatment[19].

If the extraction cannot be avoided necessary extraction can be performed within 4 months following the completion of radiation treatment. The risk of ORN does not diminish with time, the longer the clinicians wait the less healing occurs, and the greater the risk of ORN[20]. Tooth extraction should be performed under carefully controlled conditions with minimum mucoperiosteal flap and alveoloplasty and also atraumatic approach. Prescribing antibiotics coverage before and after extraction is recommended. Bone exposure after extraction should be treated conservatively such as using local saline irrigation with an occasional use of oral antibiotics before giving radical surgical treatment[27,63].

It is recommended that patients who had teeth extracted immediately before radiotherapy wait at least one year before wearing dentures[21]. Dentures ill-fitting or with function problems in xerostomia often occur because of the loss of saliva adhesive effect, denture adhesive may help to retain dentures[37]. Soft liner is recommended for prosthesis in order to prevent tissue trauma. After initial recovery from radiation effects, non surgical periodontal therapy is appropriate for teeth retained in the radiation field, usually with prophylactic antibiotics coverage[16].

Conclusion

The oral assessments and dental care prior to cancer treatment is essential to eliminate predisposing factors of trauma and infections in prevention of oral complications from cancer therapy. Meticulous maintenance of oral hygiene and topical fluoride application are essential in prevention and management of oral complications. Palliative and conservative treatments are still the treatment of choice for oral complications. Periodically oral assessments and care should be performed during and after cancer treatment for the early detection and interventions of any treatment complications.

Acknowledgements

The authors wish to thank Dr. Mathirut Mungthin for his great support, invaluable suggestions and comments in preparing the manuscript.

References

1. Lockhart PB, Clark J. Pretherapy dental status of patients with malignant conditions of the head and neck. Oral Surg Oral Med Oral Pathol 1994; 77: 236-41.
2. Mealy BL, Semba SE, Hallmon WW. Dentistry and the cancer patient. Part 1. Oral manifestations and complications of chemotherapy. Compendium Cont Educ Dent 1994; 15: 1252-66.
3. Epstein JB, Parker IR, Epstein MS, Stevenson-Moore P. Cancer-related oral health care services and resources: a survey of oral and dental care in Canadian cancer centres. J Can Dent Assoc 2004; 70: 302-4.
4. Dobrossy L. Epidemiology of head and neck cancer: magnitude of the problem. Cancer Metastasis Rev 2005; 24: 9-17.
5. Scully C, Epstein JB. Oral Health Care for the Cancer Patient Oral Oncol. Eur J Cancer 1996; 32: 281-92.
6. Lalla RV, Peterson DE. Oral Mucositis. Dent Clin North Am 2005; 49: 167-84.
7. Collins R, Flynn A, Melville A, Richardson R, Eastwood A. Effective health care: management of head and neck cancers. Qual Saf Health Care 2005; 14: 144-8.
8. Hanna E, Alexiou M, Morgan J, Badley J, Maddox AM, Penagaricano J, et al. Intensive chemoradiotherapy as a primary treatment for organ preservation in patients with advanced

cancer of the head and neck: efficacy, toxic effects, and limitations. Arch Otolaryngol Head Neck Surg 2004; 130: 861-7.
9. Chang KKF, Molassiotis A, Chang AM, Cwai W, Cheung SS. Evaluation of an oral care. Protocol intervention in the prevention of chemotherapy-induced oral mucositis in paediatric cancer patients. Eur J Cancer 2001; 37: 2056-63.
10. National Cancer Institute:U.S. National Institutes of Oral Health, Oral Complications of Chemotherapy and Head/Neck Radiation(PDQ®) Health Profesional version. At http://cancer.gov/cancertopics/pdq/supportivecare/oralcomplications/healthpr 3/4/2005.
11. Hancock PJ, Epstein JB, Sadler GR. Oral and dental management related to radiotherapy for head and neck cancer. J Can Dent Assoc 2003; 69: 585-90.
12. The Research Science and Therapy Committee of the American Academy of Periodontilogy. Position Paper. J Periodontol 1997; 68: 791-801.
13. Porceddu SV, Campbell B, Rischin D, Corry J, Weih L, Guerrieri M, et al. Postoperative chemoradiotherapy for high-risk head-and-neck squamous cell carcinoma. Int J Radiat Oncol Biol Phys 2004; 60: 365-73.
14. Joyston-Bechal S, Hayes K, Davenport ES, Hardie JM. Caries incidence, mutans streptococci and lactobacilli in irradiated patients during a 12-month preventive programme using chlorhexidine and fluoride. Caries Res 1992; 26: 384-90.
15. Rutkauskas JS, Davis JW. Effects of chlorhexidine during immunosuppressive chemotherapy. A preliminary report. Oral Surg Oral Med Oral Pathol 1993; 76: 441-8.
16. Vissink A, Burlage FR, Spitkervet FKL, Jansma J, Coppes RP. Prevention and treatment of the consequences of head and neck radiotherapy. Crit Rev Oral Biomed 2003; 14: 213-25.
17. Andrews N, Griffiths C. Dental complications of head and neck radiotherapy: Part 2. Aust Dent J 2001; 46: 174-82.
18. Epstein JB, Stevenson-Moore P. Periodontal disease and periodontal management in patients with cancer. Oral Oncol 2001; 37: 613-9.
19. Sulaiman F, Huryn JM, Zlotolow IM. Dental extractions in the irradiated head and neck patient: a retrospective analysis of Memorial Sloan-Kettering Cancer Center protocols, criteria, and end results. J Oral Maxillofac Surg 2003; 61: 1123-31.
20. Lieblich SE, Piecuch JF. Infections of the jaws, including infected fractures, osteomyelitis, and osteoradionecrosis. Atlas Oral Maxillofac Surg Clin North Am 2000; 8: 121-32.
21. Peter E, Monopoli M, Woo SB, Sonis S. Assessment of post-endodontic asymptomatic periapical radiolucencies in bone marrow transplant recipients. Oral Surg Oral Med Oral Path 1993; 76: 45-8.
22. Porter SR, Scully C. An update of the etiology and management of xerostomia. Oral Surg Oral Med Oral Path 2004; 97: 28-46.
23. Trotti A, Bellm LA, Epstein JB, Frame D, Fuchs HJ, Gwede CK, et al. Mucositis incidence, severity and associated outcomes in patients with head and neck cancer receiving radiotherapy with or without chemotherapy: a systemic literature review. Radiother Oncol 2003; 66: 253-62.
24. Garfunkel AA. Oral Mucositis-The search for a solution. N Engl J Med 2004; 351: 2649-51.
25. Maxymiw WG, Wood RE, Liu F. Post-radiation dental extractions without hyperbaric oxygen. Oral Surg Oral Med Oral Pathol 1991;72:270-4.

26. Scully C, Epstein J, Sonis S. Oral Mucositis: A Challenging Complication of Radiotherapy, Chemotherapy, and Radiochemotherapy: Part 2: Diagnosis and Management of Mucositis. Head Neck 2004; 1: 77-84.
27. Dahlin C. Oral Complications at the End of Life. AJN 2004; 104: 40-7.
28. Rubenstein EB, Peterson DE, Schubert M, Keefe D, Maguire D, Epstein J, et al. Clinical practice guidelines for the prevention and treatment of cancer therapy-iduced oral and gastrointestinal mucositis. Cancer 2004; 100: 2026-46.
29. Epstien JB, Schubert MM. Oropharyngeal mucositis in cancer therapy. Review of pathogenesis, diagnosis and management. Oncology (Huntingt) 2003; 17: 1767-79.
30. Braaksma MM, Wijers OB, van Sornsen de Koste JR, van der Est H, Schmitz PI, Nowak PJ, et al. Optimisation of conformal radiation therapy by intensity modulation: cancer of the larynx and salivary gland function. Radiother Oncol 2003; 66: 291-302.
31. Bussels B, Maes A, Flamen P, Lambin P, Erven K, Hermans R, et al. Dose-response relationships within the parotid gland after radiotherapy for head and neck cancer. Radiother Oncol 2004; 73: 297-306.
32. Seikaly H, Jha N, McGaw T, Coulter L, Liu R, Oldring D. Submandibular gland transfer: a new method of preventing radiation-induced xerostomia. Laryngoscope 2001; 111: 347-52.
33. Epstein JB, Robertson M, Emerton S, Phillips N, Stevenson-Moore P. Quality of life and oral function in patients treated with radiation therapy for head and neck cancer. Head Neck 2001; 23: 389-98.
34. Chambers MS, Garden AS, Kies MS, Martin JW. Radiation-induced xerostomia in patients with head and neck cancer: pathogenesis, impact on quality of life, and management. Head Neck 2004; 26: 796-807.
35. Nieuw Amerongen AV, Veerman EC. Current therapies for xerostomia and salivary gland hypofunction associated with cancertherapies. Support Care Cancer 2003; 11: 226-31
36. Al- Hashimi I, Taylor SE. A new medication for treatment of dry mouth in Sjogren's syndrome. Texas Dent J 2001; 118: 262-6.
37. Buntzel J, Glatzel M, Kuttner K, Weinaug R, Frohlich D. Amifostine in simultaneous radiochemotherapy of advanced head and neck cancer. Semin Radiat Oncol 2002; 12: 4-13.
38. Koukourakis MI. Amifostine in clinical oncology: current use and future applications. Anticancer Drugs 2002; 13: 181-209.
39. Wasserman T, Mackowiak JI, Brizel DM, Oster W, Zhang J, Peeples PJ, et al. Effect of amifostine on patient assessed clinical benefit in irradiated head and neck cancer. Int J Radiat Oncol Biol Phys 2000; 48: 1035-9.
40. Nguyen NP, Sallah S, Karlsson U, Antoine JE. Combined chemotherapy and radiation therapy for head and neck malignancies: quality of life issues. Cancer 2002; 94: 1131-41.
41. Warde P, O'Sullivan B, Aslanidis J, Kroll B, Lockwood G, Waldron J, et al. A phase III placebo-controlled trial of oral pilocarpine in patients undergoing radiotherapy for head-and-neck cancer. Int J Radiat Oncol Biol Phys 2002; 54: 9-13.
42. Saarilahti K, Kouri M, Collan J, Hamalainen T, Atula T, Joensuu H, et al. Intensity modulated radiotherapy for head and neck cancer: evidence for preserved salivary gland function. Radiother Oncol 2005; 74: 251-8.
43. Harrington KJ, Nutting CM, Pandha HS. Gene therapy for head and neck cancer. Cancer Metastasis Rev 2005; 24: 147-64.

44. Scully C. Drug Effect on Salivary Glands: Dry mouth. Oral Disease 2003; 9: 165-76.
45. Biron P, Sebban C, Gourmet R, Chvetzoff G, Philip I, Blay JY. Research controversies in management of oral mucositis. Support Care Cancer 2000; 8: 68-71.
46. Kami M, Machida U, Okuzumi K, Matsumura T, Mori Si S, Hori A, et al. Effect of fluconazole prophylaxis on fungal blood cultures an autopsy-based study involving 720 patients with haematological malignancy. Br J Haematol 2002; 117: 40-6.
47. Raber-Durlacher JE, Epstien JB, Raber J, Jaap van Dissel JT, van Winkelhoff AJ, Gulot HFL, et al. Periodontal infection in cancer patients treated with high-dose chemotherapy. Support Care Cancer 2002; 10: 466-73.
48. Akintoye SO, Brennan MT, Graber CJ, McKinney BE, Rams TE, Barrett AJ, et al. A retrospective investigation of advanced periodontal disease as a risk factor for septicemia in hematopoietic stem cell and bone marrow transplant recipients. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2002; 94: 581-8.
49. Mathews RH, Ercal N. Prevention of mucositis in irradiated head and neck cancer patients. J Exp Ther Oncol 1996; 1: 135-8.
50. Samonis G, Mantadakis E, Maraki S. Orofacial viral infections in the immunocompromised host. Oncol Rep 2000; 7: 1389-94.
51. Vancikova Z, Dvorak P. Cytomegalovirus infection in immunocompetent and immunocompromized individuals. Curr Drug Targets Immune Endocr Metabol Disord 2001; 1: 179-87.
52. Leflore S, Anderson Pl, Fletcher CV. A risk-benefit evaluation of aciclovir for the treatment and prophylaxis of herpes simplex virus infections. Drug Saf 2000; 23: 131-42.
53. Naesens L, De Clercq E. Recent developments in Herpesvirus therapy. Herpes 2001; 8: 12-6.
54. Hay D. Management of oral problems associated with cancer treatment: radiotherapy.At http://www.8.co.nz/hospitaldentistry/papers/Management of Oral Problems Associate. 3/22/2005.
55. Jerry KW Jr. Nonsurgical Cancer Therapies: Dental Complications and Patient Management. At http://das.cs.amedd. armedd.army. mil/journal/J9721.HTM. 3/25/2005.
56. Scully C, Ward-Booth P. Detection and treatment of early cancers of the oral cavity. Crit Rev Oncol 1995; 21: 63-75.
57. Oh HK, Chambers MS, Garden AS, Wong PF, Martin JW. Risk of osteoradionecrosis after extraction of impacted third molars in irradiated head and neck cancer patients. J Oral Maxillofac Surg 2004; 62: 139-44.
58. Keller EE. Placement of dental implants in the irradiated mandible: a protocol without adjunctive hyperbaric oxygen. J Oral Maxillofac Surg 1997; 55: 972-80.
59. Sanger JR, Matloub HS, Yousif NJ, Larson DL. Management of osteoradionecrosis of the mandible. Clin Plast Surg 1993; 20: 517-30.
60. Tong AC, Leung AC, Cheng JC, Cheng JC, Shan J. Incidence of complicated healing and osteoradionecrosis following tooth extraction in patients receiving radiotherapy for treatment of nasopharyngeal carcinoma. Aust Dent J 1999; 44: 187.
61. Bui QC, Lieber M, Withers HR, Corson K, van Rijnsoever M, Elsaleh H. The efficacy of hyperbaric oxygen therapy in the treatment of radiation-induced late side effects.Int J Radiat Oncol Biol Phys 2004; 60: 871-8.

62. Jereczek-Fossa BA, Orecchia R. Radiotherapy-induced mandibular bone complications. Cancer Treat Rev 2002; 28: 65-74.
63. Curi MM, Dib LL, Kowalski LP. Management of refractory osteoradionecrosis of the jaws with surgery and adjunctive hyperbaric oxygen therapy. Int J Oral Maxillofac Surg 2000; 29: 430-4.
64. Chavez JA, Adkinson CD. Adjunctive hyperbaric oxygen in irradiated patients requiring dental extractions: outcomes and complications. J Oral Maxillofac Surg 2001; 59: 518-22.
65. Niewald M, Barbie O, Schnabel, K. Risk factors and dose-effect relationship for osteoradionecrosis after hyperfractionated and conventionally fractionated radiotherapy for oral cancer. Br J Radiol 1996; 69: 847-51.
66. Maxymiw WG, Wood RE, Liu F. Post-radiation dental extractions without hyperbaric oxygen. Oral Surg Oral Med Oral Pathol 1991; 72: 270.
67. Assael LA. New foundations in understanding osteonecrosis of the jaws. J Oral Maxillofac Surg 2004; 62: 125-6.
68. David LA, Sandor GK, Evans AW, Brown DH. Hyperbaric oxygen therapy and mandibular osteoradionecrosis: A retrospective study and analysis of treatment outcomes. J Can Dent Assoc 2001; 67: 384.
69. Maier A, Gaggl A, Klemen H, Santler G, Anegg U, Fell B, et al. Review of severe osteoradionecrosis treated by surgery alone or surgery with postoperative hyperbaric oxygenation. Br J Oral Maxillofac Surg 2000; 38: 173-6.
70. Marx RE, Ehler WJ, Tayapongsak P, Pierce LW. Relationship of oxygen dose to angiogenesis induction in irradiated tissue. Am J Surg 1990; 160: 519-24.
71. Chavez JA, Adkinson CD. Adjunctive hyperbaric oxygen in irradiated patients requiring dental extractions: outcomes and complications. J Oral Maxillofac Surg 2001; 59: 518-22.

การดูแลสุขภาพช่องปากในผู้ป่วยโรคมะเร็งบริเวณใบหน้าและลำคอ

สิริกาญจน์ สุทธวงษ์, พรชัย จันศิษยานนท์, นริศา บุณโยปัษฎัมภ์

การตรวจในช่องปากและการรักษาทางทันตกรรมก่อนการรักษามะเร็งในผู้ป่วยโรคมะเร็งที่บริเวณศีรษะและลำคอมีความสำคัญ โดยช่วยขจัดสาเหตุปัจจัยที่ทำให้เกิดอาการแทรกซ้อนในช่องปากจากการรักษาโรคมะเร็ง การดูแลสุขอนามัยช่องปากอย่างพิถีพิถัน และการใช้ฟลูออไรด์เฉพาะที่มีความจำเป็นในการป้องกันและรักษาอาการแทรกซ้อนที่เกิดในช่องปาก การรักษาตามอาการของโรคยังคงเป็นการรักษาที่ได้รับความนิยม ผู้ป่วยที่ได้รับการรักษาโรคมะเร็งบริเวณศีรษะและลำคอควรตรวจภายในช่องปากอย่างสม่ำเสมอ เพื่อเฝ้าระวังอาการแทรกซ้อนในช่องปากซึ่งเป็นผลตามมาจากการรักษาโรคมะเร็งและจะได้ทำการรักษาแต่เนิ่น ๆ