

Oral and Dental Complications of Head and Neck Radiotherapy and their Management

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ABSTRACT

Cancer patients who are diagnosed early and or receive effective anti tumour therapy can expect to live for many years after treatment and therefore preservation of normal tissue function is crucial to ensure long term quality of life.

Oral complications affect hundred per cent of patients who receive radiotherapy to fields involving the oral cavity and combined modality treatment with chemotherapy may compound these effects. Oral cavity is highly susceptible to side effects as radiotherapy targets cells that divide rapidly and the cells of the mucosal lining of the mouth are rapidly dividing cells and they are thus injured. All patients who are to receive radiotherapy to the head and neck region should be sent for a dental consultation prior to the initiation of their treatment in order to decrease the acute and chronic post treatment sequelae.

Keywords: Dental management; head and neck cancers; radiotherapy.

INTRODUCTION

All head and neck cancer patients receiving radiotherapy to the mandible/maxilla require dental care prior to; during and after radiotherapy. Oral complications of head and neck cancer radiotherapy are more predictable; more severe and can lead to permanent tissue changes that put the patient at risk for serious chronic complications.

Radiotherapy to the salivary glands can cause pH of the saliva to alter leading to proliferation of bacteria and fungi which in turn leads to infection and soft tissue complications further leading to xerostomia.¹ Radiotherapy to oral cavity also causes mucositis, pain, trismus, changes in taste (dysgeusia) and even osteoradionecrosis (ORN).² It can also lead to changes in dental growth and development in children.

The aim of dental care should be to reduce or relieve the unpleasant and deleterious side effects associated with radiotherapy and promote the maintenance of good oral

health after radiotherapy. All radiotherapy departments should either have a full time dental consultant or should include pre radiotherapy dental care in their protocol and send all the patients for dental opinion. Ideally the dental examination and necessary dental treatment should be performed prior to the onset of definitive cancer treatment.³

Here we discuss some of the complications usually seen; their management and some recommendations to be followed prior to, during and after radiotherapy.

The side effects of radiotherapy can be broadly classified into acute (during treatment) and chronic (following radiotherapy). Acute reactions include mucositis, sialadenitis, infection and taste dysfunction. Chronic reactions are due to changes in the vascularity and cellularity of the soft tissue and bones; damage to the salivary glands and increased collagen synthesis leading to further hypovascularity and this hypoxia of tissues

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leads to mucosal and cutaneous fibrosis, xerostomia, caries, dysphagia, ORN, temporo-mandibular joint (TMJ) disorders and psychosocial impact.

MUCOSITIS

The severity depends on quality of dental hygiene, treatment schedule, irradiated area and volume and amount (dose) of radiotherapy given. It also depends upon the age of the patient. It may be aggravated by trauma of ill fitting dentures. The patient complains of pain, bleeding and burning sensation; all leading to inability to eat, drink or swallow.

Mucositis is usually characterized by erythema, edema, mucosal shedding, ulceration and pseudo membrane formation. Severe symptoms limit the ability of the patient to tolerate radiotherapy and therefore cause delay in treatment and thereby limits the effectiveness of the cancer therapy.

Mucositis also compromises body's defense against invasion of micro-organism from the oral cavity into the blood stream increasing the risk of systemic infection from fungi and bacteria.

It also can lead to superadded infection for which antibiotics are given leading to alteration of the normal bacterial flora further leading to proliferation of fungi. Most common fungal infection is candidiasis which may increase the symptoms of mucositis.⁴

Treatment is usually symptomatic and includes therapeutic mixture of various topical anesthetics and analgesics and mucosal coating agents such as lignocaine/ Xylocaine mouth washes.⁵ Zinc supplements may improve mucositis and dermatitis.⁶ Application and chewing of ice chips leads to vasoconstriction leading to decreased blood flow and thereby causing relief in the burning sensation caused by mucositis. Fluoride rinses also provides symptomatic relief. The fungal infection should be treated with topical lozenges and if necessary systemic antifungals.

DYSGEUSIA

Dysgeusia is defined as loss of taste; which is due to damage of the taste bud cells in the tongue papilla.^{7,8} It is increased by mucositis and xerostomia. It is seen in all patients in whom the tongue is irradiated or is included in the radiation portals. Taste usually returns within a few months. Zinc sulfate supplements (220mg two to three times per day) have been reported to help with the recovery of sense of taste.⁹ Although the specific role of Zinc in the control of taste is unknown; it is functionally involved at several levels of cellular organization. At

the receptor level, in the taste bud, zinc is a cofactor in alkaline phosphatase, the most abundant enzyme isolated from the taste bud membrane.

CARIES AND DEMINERALIZATION

A decrease in quantity and change in quality of saliva (in terms of pH) deprives the oral cavity of protective property of saliva (by decreasing the bactericidal salivary proteins). It also decreases the calcium and phosphate ions necessary to maintain the hydroxy-apatite content of tooth enamel and dentin.

All these changes contribute to dental caries, hypersensitivity of teeth and demineralization.

The treatment includes maintaining good oral hygiene; manage xerostomia, topical fluoride application (which increases contact time via the use of customized tray/ carriers) and the use of remineralising agents. Diet modification in terms of elimination / reduction in intake of sugars, avoidance of dry, acidic, spicy and flavoured foods and avoidance of alcohol and tobacco.

Xerostomia

Radiotherapy to the salivary glands leads to glandular tissue damage leading to fibrosis, degeneration, acinar atrophy and cellular necrosis; all leading to dry mouth (xerostomia). A decrease in the saliva does not allow the oral cavity to neutralize the acid, clean the teeth and gums or protect from infection. The altered saliva becomes thick and stringy and leads to thick and heavy plaques, dental decay, demineralization of teeth, change in taste, change in swallowing and speech, sore and burning sensation in the mouth, cuts and cracks in the lips and angle of mouth and difficulty in wearing dentures.

It contributes to loss of appetite, chronic oesophagitis and gastro-oesophageal reflux. It has a debilitating impact on health and overall quality of life in head and neck cancer patients and survivors.¹⁰

Xerostomia is typically not reversible and the chronic effects may persist for months/years with the recovery typically depending on area irradiated; total dose of radiation and individuality of patient.

The extent of radiation induced xerostomia is usually dependent upon the radiation portals; total radiation dose and initial volume and function of the salivary glands. There are several ways in which the radiation injury to the salivary glands can be minimized or prevented and they include salivary gland transplantation,¹¹ use of radio-protector agents such as amifostine¹² and advanced radiation techniques such as Intensity Modulated Radiation Therapy (IMRT).¹³

The treatment of xerostomia includes dietary modification; maintenance of good oral hygiene; use of fluoride trays and salivary stimulation or substitution. Diet modification includes use of cold, bland and soft food and avoidance of spicy and hard foods.

For responders i.e. patients with residual salivary function salivary glands can be stimulated by either mastication; which gives physiological stimuli for salivation or by encouraging the use of vitamin C, lozenges, sugarless candies and sugarless chewing gums. Sialogogues which are systemic salivary gland stimulants (cholinergic action) can be used to stimulate salivary flow through local and direct cellular stimulation. The most commonly studied and used is Pilocarpine with a dosage of 5-10 mg thrice daily and a minimum of 90 days treatment is required to give some meaningful benefit.¹⁴ As Pilocarpine as cholinergic activity; it is not recommended for patients with cardiovascular disease and it is contra-indicated in patients with narrow angle glaucoma and uncontrolled asthma.

For non responders an i.e. patient with no residual salivary function the use of saliva substitutes is recommended. Patients are usually advised frequent sips of water. Synthetic saliva solutions are commercially available for use and mucin containing solutions are better.¹⁵

TRISMUS

It is the inability to open the mouth properly and usually is the result of fibrotic changes to the muscles of mastication and temporo-mandibular joint (TMJ) when they are included in the radiation fields. The full extent of trismus becomes evident 3-6 months after the treatment.

Trismus along with impaired salivary production (xerostomia) leads to difficulty in maintaining adequate oral hygiene and also leads to impaired speech and adequate nutrition intake.

It is therefore advised to extract all loose/ mobile teeth having bad prognosis prior to radiotherapy treatment.

The main treatment of trismus is stretching exercises during and also after the treatment with special appliances or even improvised small ice cream wooden sticks.

OSTEORADIONECROSIS

Irreversible progressive devitalisation of the irradiated bone is known as osteoradionecrosis (ORN); i.e. bone death. Radiotherapy leads to hypo vascularisation which in turn decreases the bone ability to withstand trauma and avoid infections.

The process is facilitated by poor nutrition and hygiene. It occurs in 3-10% of cases. Approximately 1/3rd ORN occur with soft tissue breakdown over non-viable bone and 2/3rd are initiated by traumatic incidents leading to non healing soft tissue and bone lesions which leads to necrosis and secondary infection.¹⁶

Poor oral hygiene and continuous use of alcohol and tobacco leads to increase in ORN. Therefore there is more stress on prevention; which includes detection and elimination of dental pathology, including infected retained roots, bony spicules or sharp edges of otherwise hopeless teeth.

Any pre-radiotherapy extraction if required; should be performed with alveoloplasty (to ensure a smooth ridge) and primary closure. Other measures include maximizing periodontal health; initiation of fluoride therapy prior to treatment and wearing of dentures to a minimum at least for a year after treatment.¹⁷

In case ORN sets in; the treatment would include local wound care, excellent oral hygiene, antibiotics (after culture and sensitivity tests), elimination of trauma/ avoidance of removable dental prosthesis if the denture bearing area is within the osteo necrotic field, adequate nutritional intake, discontinuation of alcohol and tobacco usage, local resection of bone sequester and as a last resort partial mandibulectomy.

Another promising management option is the use of hyperbaric oxygen. It increases oxygenation of the irradiated tissue leading to promotion of angiogenesis and enhancing osteoblast repopulation and fibroblast functions.¹⁸

PRE RADIOTHERAPY RECOMMENDATIONS

The efficacy of pre radiotherapy dental screening is well documented.¹⁹ The management should start at least 2 weeks prior to starting radiotherapy.²⁰ Discussion should be held with the surgeons in order to decrease multiple general anaesthesia sittings and plan for prosthetic rehabilitation. Radiation Oncologists should be consulted in order to understand the nature of radiotherapy and details of radiotherapy (i.e. timings/radiotherapy portals in order to understand which bone will be in the direct line of the radiotherapy beam etc).

The various measures would include: 1) identifying and treating existing infections/ problem teeth and tissue injury 2) removal of orthodontic bands if they are within the radiotherapy field 3) evaluate dentures and appliances for comfort and fitting 4) extraction of unsalvageable teeth especially within the radiotherapy field. When considering extraction; the following should be kept in mind: a) all teeth with bad prognosis should

be removed, b) teeth with pulpally involved carious lesions and periapical pathology should be treated with pulpotomy or complete pulpectomy (root canal treatment) and can be saved and teeth with advanced periodontal disease should be extracted, c) in children extract highly mobile primary teeth and teeth that are expected to exfoliate during treatment.²¹

5) Treatment of pre-existing oral conditions such as calculus, tartar, broken or sharp teeth and restoration of caries. 6) Strict instructions that would include a) weekly visit during the treatment, b) meticulous cleaning of dentures, c) oral hygiene and flossing technique with unwaxed floss (as waxed floss leaves residue between the teeth whereas unwaxed floss after getting past the contact fans out and causes more fibres running along the tooth removing more plaque) and use of mouth rinses, d) use of fluoride gel with fabricated custom fluoride trays, e) avoidance of alcohol and tobacco, f) instruction on proper brushing techniques which includes using soft bristles and fluoridated paste and using soda bicarbonate rinses.²² Alcohol containing rinses should be avoided as they irritate the mucosa and also cause dryness and are thus not recommended.²³

The use of sialogogues during radiotherapy should be discussed prior to starting the treatment.²⁴

RECOMMENDATIONS DURING RADIOTHERAPY

During the radiotherapy treatment the patients should be advised for regular dental visit, maintenance of good oral hygiene, plenty of oral fluids and frequent mouth rinses and mouth opening exercises also known as mechanotherapy.

They should also be advised for dietary modification such as taking soft bland diet and avoidance of irritants like spices, alcohol, tobacco and hot foods.

For brushing they should use soft bristles and soak them in warm water prior to use. Topical fluoride therapy using custom made fluoride trays as bed time should be recommended.

POST RADIOTHERAPY RECOMMENDATIONS

Once the radiotherapy treatment concludes; the patient should be advised for regular dental check up every four weeks for the first six months. General instructions include the use of soft brushes, mouth rinses with soda bicarbonate powder, frequent sips of water and avoid hot food and drinks, spicy food, alcohol and smoking and also to attend dietary counselling.

Once the mucositis subsides; the oncology team should be consulted about the use of dentures and other

appliances. A close watch must be kept for development of caries, demineralization and trismus.

Life long daily application of fluoride gels are needed for patients with xerostomia.

All oral surgery on irradiated bone should be advised against due to the risk of osteoradionecrosis. Tooth extraction, if unavoidable should be conservative, using antibiotic coverage and possible hyperbaric oxygen.

SUMMARY

Systematically applied oral hygiene protocols may reduce the incidence, severity and duration of oral complications during and after radiotherapy for head and neck cancer patients.²⁵ All patients who are planned for radiotherapy to the head and neck region should be advised to consult a dental surgeon prior to the initiation of their treatment in order to try and minimize the oral complications of radiotherapy.

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