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Review Article

Management of oral health in patients irradiated for head and neck cancer: A review

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Abstract
Management of oral health plays an integral role in the treatment of Head & Neck Cancers. Radiation therapy is a significant treatment modality in the management of Head and Neck Cancers. However, high dose of radiation is also associated with side effects. Oral health management plays an important role in preventing these complications. Therefore it is mandatory to initiate prompt oral health care that can prevent the associated orodental complications. This article is a review on oral complications associated with radiation therapy, their prevention and management.

Radiation therapy is a viable treatment modality in patients of head and neck cancers. High doses of radiation to oral cavity and salivary glands can have dramatic effects on patient's oral health. Therefore, the oral health care of irradiated patient demands particular attention. A dentist must follow the patient closely before, during and after the radiation therapy or chemotherapy and initiate dental care programme that can greatly aid in reducing orodental complications in patients post therapy phase when normal functions of the oral tissues have been considerably impaired.

Comprehensive oral care programme before radiation

Once a definitive oncological diagnosis is made, a pre-radiation therapy dental consultation report is initiated. The radiation oncologist will need to provide information such as the location or site of the cancer, its extent, histopathological details, type, duration, dose, and intent of radiation therapy, the area of exposure of radiation and prognosis.

Dental evaluation

Dental professionals should document the level of oral hygiene, caries involvement and intended dental treatment plan. Radiographic studies determine the periapical, periodontal status of teeth and tumour invasion of bone. The treatment must be completed as quickly as possible, prior to the initiation of radiation therapy. An appropriate amount of healing time must also be considered. Patients with systemic illnesses such as Diabetes mellitus, hypertension, cardiopulmonary disease and alcoholism should be carefully evaluated.

Extraction of non-salvageable teeth

Questionable teeth are often extracted so as not to necessitate their extraction during radiation therapy. Many articles have been published regarding whether or not to extract teeth in the radiation field and the reports are often contradictory. Extraction of only those teeth in the primary field of radiation prior to radiation have been reported.[1] In contradiction several authors suggest maintenance of as many teeth as possible and extraction of only non-salvageable teeth[2]. It is considered hazardous to perform extractions once the radiation therapy begins. The problems encountered in such extractions are oedema, endarteritis, hyalinization of small vessels and gradual diminution of the blood supply. Extractions should be atraumatic and should be limited to 2-3 teeth at a time. Ideally, extraction sites should be allowed at least 10-14 days for proper healing prior to the initiation of radiotherapy.

Restoration of teeth with dental caries

Carious teeth and fractured teeth should be restored prior to the radiotherapy. It has been suggested to use a light activated glass ionomer with fluoride – releasing capabilities as the material of choice[3]. If the condition of the patient does not permit definitive dental care the restorative treatment may be deferred to after the radiotherapy, after the caries excavation and temporary restoration.

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Maintenance of oral hygiene and preventive care
Initial oral hygiene appointment consists of patient education, oral prophylaxis, fluoride treatment and recall visit. Patient education should review the oral hygiene, habits and techniques, additional hygiene supplements, current oral hygiene status, side effects of therapy and the consequences of neglect.

Brushing with a soft tooth brush 2-4 times daily is recommended followed by rinsing to eliminate loosened debris. Several rinse solutions like hydrogen peroxide and saline or hydrogen peroxide and water, sodium bicarbonate may be used. Alcohol containing mouth washes may irritate or dry the mucosa and are not recommended. Daily flossing with unwaxed dental floss is advised. Oral prophylaxis is performed and instructions given on the use of neutral 1% sodium fluoride gel. Patient is recalled at 2 weeks interval to help manage and motivate the patient during the therapy.

Maxillofacial prosthetics
The surgical resection of head and neck neoplasm can lead to facial deformities. In addition, effects of radiotherapy may further impair eating, speaking, oral hygiene and may limit access for future dental treatment. Maxillofacial prosthodontists as a part of multidisciplinary team have a major role to play in the reconstruction of facial defects.

During the therapy
Oral hygiene regime and fluoride toothpaste or gel is continued throughout the therapy to help prevent the rampant caries, plaque accumulation, and demineralization of the teeth. Ill fitting dentures are avoided due to tissue fragility. The use of tobacco and alcohol is strongly discouraged. Furthermore patient is made aware that the smoking increases the xerostomia and mucositis

Radiation side effects
Most of the oral complications of radiotherapy are dose dependent. The tissues that are affected by radiation in head and neck area are salivary glands, mucous membranes, taste buds, bone, teeth and temporomandibular joint. To minimize patient discomfort and morbidity, an understanding of the deleterious effects of radiation on these tissues is required.

Salivary Glands
Despite the slow rate of mitosis, the well differentiated salivary glands are radiosensitive. Effect of radiation on the salivary gland depends on the volume of the gland, dose and functional state of the gland prior to radiotherapy.[4] The serous acinar cells are more sensitive than mucosal cells.[5] Ionizing radiation causes glandular tissue damage, which may result in rapid irreversible loss of salivary flow secretion.[6] After radiotherapy, there is progressive degeneration of the fine vasculature of the salivary glands. A mean dose of 60 Gy is the threshold for producing irreversible damage, in some cases doses as little as 26 Gy have been implicated[7]. The amount of parotid gland irradiated appears to be the major determining factor for xerostomia. Patients with xerostomia are more susceptible to periodontal disease, rampant caries and oral fungal and bacterial infections as a result of alteration in host defences and microbial equilibrium. In addition all the physiologic functions associated with the saliva may be affected. Candidiasis is the most common oropharyngeal infection in patients who receive radiation therapy.[8] They occur during the therapy and persist even after the therapy**.** Erythema occurs bilaterally and symmetrically, and in areas not within the radiation fields. In chronic forms of candidiasis, infection most commonly occurs in the corners of the mouth and beneath the prosthesis. Topical antifungal agents and systemic antifungals are prescribed. A variety of saliva substitutes and moisturizers are available in the market. The use of sugarless gums or candies may be helpful to stimulate salivary secretion. To reduce increased caries risk chlorhexidine gluconate, an antimicrobial rinse, which has both antifungal and antibacterial properties in addition to antiplaque effects can be used.

Mucous Membranes
Mucositis is characterized by inflammation and ulceration of the mucosa. Mucositis develops secondary to the depletion of the rapidly dividing basal cell layer of the epithelium.[9] Mucosal cells have high turn over rate and low radiation resistance and hence are very susceptible to radiation injury. There are four distinct phases associated with chemotherapy induced mucositis: inflammatory, epithelial, ulcerative and healing.[10] With fractionated doses of 2 Gy, mucosal erythema appears within one week. It intensifies with continued treatment. Mucositis depends on fractionation and protraction of dose, site of lesion, level of oral hygiene and beam angulation.[11] Four weeks after the completion of the treatment, 90-95 % of patients show complete resolution of mucositis. The management of mucositis is mainly conservative. Patient should brush 2-4 times daily with soft bristled brush to minimize trauma to the oral tissues. Ill fitting prosthesis should be avoided. Soft diet that does not irritate the mucosa should be taken. Patient should refrain from alcohol and tobacco and frequently rinse with a sodium bicarbonate solution. Pain associated

with mucositis can be reduced with coating agents, topical anaesthetics and analgesics.

Taste buds

Dysgeusia occurs rapidly and exponentially up to 30 Gy and then slows as acuity for all types of taste reaches zero. Taste acuity is partially restored in 20 to 60 days after the completion of radiation and is restored almost completely four months post radiation in most of the patients.[12] However some patients may experience life long alteration or loss of taste. Dysgeusia or ageusia causes anorexia and malaise in patients as patients quickly lose interest in food. This may lead to compromised nutritional status. Patients are encouraged to maintain a normal, balanced diet to ensure adequate nutrition.

Bone

The changes in the bone exposed to high doses of radiation include endothelial cell death, hyalinization and thrombosis and obliteration of vessels. Endosteum and periosteum atrophy with a significant reduction in the number of osteoblasts and osteoclasts. Tissue becomes hypo cellular, hypo vascular and hypoxic. This leads to minimal ability of bone to withstand trauma or to repair. Ultimate end result of these changes is osteoradionecrosis. Meyer[13] described the classic triad of osteoradionecrosis as radiation, trauma and infection, with trauma acting as the portal of entry for oral bacterial flora into the underlying bone. The most common causes of trauma were tooth removal and sharp, bony ridges after inadequate alveolectomies. A new concept of pathophysiology of osteoradionecrosis was reported by Marx[14]. In a microbial investigation of resected mandibles, concluded that osteoradionecrosis is not a primary infection of irradiated bone, rather microorganisms play only a concomitant role in its pathophysiology. He redefined concept of osteoradionecrosis as a metabolic and tissue homeostatic deficiency created by radiation induced cellular injury which is characterized by the sequence: radiation, formation of hypoxic-hypovascular-hypocellular tissue, tissue breakdown, and nonhealing wound.

Teeth

There is minimal data available as to the effect of radiation on the teeth. The developing dentition may be significantly affected due to the absorbed dose of radiation on the tooth bud. The potential effects of radiation include partial or complete anodontia, tooth dwarfism, incomplete root formation and localized enamel defects[15].Timing of exposure is the key factor as exposure prior to calcification may destroy the tooth bud, whereas exposure at a late stage of development may arrest growth and result in enamel and dentin irregularities. Dental pulp undergoes a decrease in vascularity, with fibrosis and atrophy. The pulpal response to infection, trauma and dental procedures is compromised. Radiation caries has a clinically distinct pattern. Smooth surfaces and normally resistant to decay are the first affected and caries development and progression are rapid. Extensive tooth destruction may develop in a matter of weeks. Caries develop either due to direct influence of radiation or secondary to xerostomia.

Temporomandibular joint

Trismus results if the temporomandibular joint and muscles of mastication fall within the radiation fields because of the fibrosis of the muscles of mastication. The mouth opening may be restricted. This can cause difficulty in intake of food, wearing of dentures and construction of new dentures. As a result nutritional status of the patient may be compromised. A regimen of mouth opening exercises 3-4 times daily can be effective.

Nutritional deficiency

The complications associated with the radiation predispose the patient to nutritional deficiency and subsequent weight loss. This is associated with increased mortality in cancer patients. Consultation with a dietician is recommended and hospitalization may be required for patients unable to maintain adequate nutritional intake.

After radiation

During this phase any dental treatment that was deferred during the therapy can be undertaken. After therapy oral hygiene regime is continued. Oral exercise is continued to reduce the risk of trismus. Dietary counselling sessions to accommodate permanent changes to the oral cavity produced by surgery and radiation .It is mandatory to follow up the patient to detect any new or recurrent cancer and to manage chronic oral complications such as xerostomia, mucositis, candidiasis and risk of osteoradionecrosis.

Conclusion

The various modalities of treatment in patients with head and neck cancer include surgery, radiation and chemotherapy. Radiotherapy in the region of oral cavity and salivary glands are often associated with oral complications. A team approach including the surgeon, radiotherapist and the dentist in managing these patients can prevent or minimize the oral complications and thus improve quality of the life of patients with cancer.

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