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Oral Complications And Its Management During Radiotherapy

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Abstract
Cancer is a class of diseases in which a cell or a group of cells display uncontrolled growth, invasion, and sometimes metastasis . The term head and neck cancer refers to a group of biologically similar cancers originating from the upper aerodigestive tract, including the lip, oral cavity , nasal cavity, paranasal sinuses, pharynx, and larynx. 90% of head and neck cancers are squamous cell carcinomas , originating from the mucosal lining (epithelium) of these regions. Radiation therapy is the most common form of treatment along with surgery and chemotherapy. There are different forms of radiation therapy, including 3D conformal radiation therapy, intensity-modulated radiation therapy, and brachytherapy, which are commonly used in the treatments of cancers of the head and neck. There are both acute and long-term sequelae of radiation therapy (RT) for head and neck cancer (HNC) that occur because of effects on normal tissues. Radiotherapy-induced oral complications are complex, dynamic pathobiological processes that lower the quality of life and predispose patients to serious clinical disorders. Radiotherapy-induced damage in the oral mucosa is the result of the deleterious effects of radiation, not only on the oral mucosa itself but also on the adjacent salivary glands, bone, dentition, and masticatory musculature and apparatus.

Dental surgeons should organize and implement preventive and therapeutic strategies in the management of various complications due to radiotherapy. The clinical features, diagnosis and management of various complications are discussed here. The present article mainly presents a brief overview of the whole programme of oral evaluation and proper care before, during & after the radiotherapy managing all the common problems involved.

Key Words
Head and neck cancer,Radiotherapy,Oral mucosa

Introduction

A patient who is undergoing radiotherapy for head & neck carcinoma (HNC) suffers from many oral complications. The national institute of health in a consensus development statement estimated that as many as 400,000 patients developed oral complications as a result of cancer treatment[1]. Generally these oral complications are painful and increase the agony of the patient who is already distressed (NIH 1989). Early dental intervention and counselling is the best way to minimize these oral complications[2]. Ideally, the dental examination and necessary dental treatment should be performed prior to the onset of definitive cancer treatment[3]. During the initial dental appointment, patient should be made to understand about the short and long term effects[4, 5] of radiation to the head and neck. Additionally, the patient should be told about increased susceptibility to oral infections and muscular fibrosis which severely limits the ability to open mouth, making dental procedures difficult to perform[6].

Adverse effects of radiotherapy:-

Usually within the 1- 2 weeks of fractionated radiation treatment[7] the salivary gland tissue which is included in the field of radiation suffers a permanent loss of function .This may ultimately lead to xerostomia or a decreased salivary flow. Saliva has a crucial role to play in the maintenance of oral homeostasis. The complex mixture of protein, glycoproteins, mucins, and ions help prevent dental caries, promotes remineralization of early carious lesions, buffers acid generation by oral bacteria, and prevents other types of oral infections[8]. Protein such as salivary peroxidise, lysozyme, and lactoferrin are antibacterial agents and limit the growth of cariogenic bacteria[8].

Histatins, a family of salivary proteins, have potent antifungal properties which limits the growth of oral yeast. Salivary gland also secretes immunoglobulins A & M which specifically acts against oral cariogenic bacteria[8].

Pre- radiation phase:

Preventive and Therapeutic Dental care

Frequent dental examination is essential to reduce the risk & severity of oral complications. Full mouth or panoramic x-rays are the necessary part of comprehensive clinical examination of the periodontium and oral soft tissues[9, 11]. To start with, an assessment of the patients' oral hygiene is made. This data acts as the base line for monitoring the effects of radiation therapy. Dental prophylaxis is done[9], and reviewed as quickly as possible. Patient education regarding the need for meticulous oral hygiene and frequent follow-up must be stressed.

Definitive restorations should be done in the case of caries.If the caries is extensive and involves pulp but the prognosis is good,Root

canal treatment should be done. If the prognosis is poor, the tooth should be extracted[3]. A healing period of at least 10 days to 3 weeks should be present, in the case of extractions, before radiation therapy begins[4]. Extractions should be done as atraumatically as possible and antibiotic coverage should be given[10].

Periodontally involved teeth exhibiting moderate to severe mobility should also be considered for removal. If there is any doubt regarding the prognosis of the tooth, extractions should be done because extraction following radiation treatment will present an increased risk of osteoradionecrosis[4, 10]. It must also be remembered that wound healing will be compromised, and extensive periodontal treatment following radiation will be contraindicated[11].

Preradiation prosthetic care:

The severity of resulting mucositis[12] will limit the patient's ability to tolerate the prosthesis during therapy. The patient must be cautioned that continuously wearing the dentures may be a source of mucosal irritation and should be advised about periodically resting the mucosa. If the denture or prosthesis is ill-fitting temporary relining materials should not be used to reline it because surface porosity and abrasiveness of these materials make hygiene procedure difficult and serve as a potential reservoir for fungal growth thereby increasing mucosal discomfort.

Dentate patients with metallic crowns or fixed partial dentures in the treatment field may suffer significant irritation to adjacent soft tissue as a result of backscatter. This problem can be minimised with the use of custom made, soft plastic stent.

In case of dental implants placed in the mouth, radiation therapists generally decide to go for the removal of implants positioned in the treatment fields.
Xerostomia: Patients with reduced salivary flow also have an increased incidence of oral fungal infections and salivary gland infections[13]. Preventive measures should be undertaken in patients with decreased salivary function.

Radiation phase:

Mucositis
One of the earliest complications of radiation therapy is the development of mucositis. The soft tissues in the treatment field, after a week or two, demonstrate a moderate amount of erythema. As radiation continues, the mucosa may exhibit varying degrees of desquamation and frank ulceration, resulting in pain and dysphagia which make it difficult for the patient to eat a well balanced diet leading to significant weight loss and malnutrition .The possible solutions are as following:

- Patient should be advised to eat small amount of meals four to six times daily rather than three big meals.
- Intake of easy to swallow nutritious fluids like soups, milk shakes and curd should be increased.
- Psychological counselling.

Acute mucositis[12] begins during the second or third week of radiation therapy and subsides within 8 to 10 weeks once treatment is completed. Good oral hygiene is perhaps the best way to reduce the complications. Frequent daily cleaning of the teeth and oral rinse with a combination of salt and sodium bicarbonate[2] in water or dilute solutions of hydrogen peroxide and water have a soothing effect on the affected areas. Other therapies have included rinsing with Benadryl elixirs sucrafate solutions, and topical anaesthetics.

Loss of taste:

Loss of taste is the most common side effect accompanying radiation to the tongue and palate during 1-2 weeks after radiotherapy which gradually returns back to normal after the course is completed. The most common contributing factors are damaged taste buds, disrupted innervations and decreased salivary flow[2].

Xerostomia:

Changes in the quantity and quality of saliva as a result of radiation have been well documented in the dental literature[5]. Beginning with the first course of treatment, salivary flow rates decrease, eventually reaching as low as 1% of normal[7].
Xerostomia may be caused by radiation therapy and drugs, severing of salivary duct and gland (accidental or intentional), decreased liquid intake or stress and anxiety. Measures taken to reduce the severity of xerostomia are[5,13]

- Radiation stents [14]can be fabricated to shield the ipsilateral side when unilateral radiation treatment is required. Another method of limiting radiation to salivary gland is conformal and **intensity-modulated irradiation technique** (IMRT) [15] .This technique targets the lesion while sparing the major salivary glands from radiation. This technique shows fewer xerostomia complaints, better quality of life and decreased loss of function of salivary glands than in patients with conventional radiotherapy.
- Patient should be encouraged to maintain an adequate fluid intake and remain hydrated to prevent bacterial infections of the glands.
- Tongue coating, due to xerostomia, impairs the taste. To overcome this, tongue should be cleaned two or three times daily with a bicarbonate soda solution.
- Sticky foods such as chocolates and pastries (cariogenic) should be avoided.
- Artificial salivary substitutes are prescribed.
- Caffeine- containing beverages, Alcohol or strong flavours should be avoided.
- Sugar free candies, gums & mints (containing xylitol) should be used.
- Secretagogues i.e. pilocarpines[16], Anethole trithione & cevimeline acts by stimulating the functioning of salivary gland tissue.
- Sugarless antifungal agents such as nystatin powder and clotrimazole vaginal troches[13] can be used to treat infections; any intraoral acrylic prosthesis used by an infected patient must be soaked in an antifungal agent.
- Salivary glands should be evacuated daily by gentle massage, sucking on sugarless candies[13], and wiping the oral cavity with glycerine swabs .This helps in preventing mucous plug formation and subsequent salivary gland infections.
- Slight modifications in the patient's medication regimen can reduce the degree of complaints due to medication-induced dryness normally salivary flow declines at night. So taking a medication that reduces flow in the morning or dividing medication doses when possible may improve oral comfort and reduce xerostomia[5,13].
- Amifostine[13, 7] is an oxygen scavenger that may protect salivary glands from free radical damage during radiation therapy. It has a broad spectrum of cyto-protective and radio- protective function which reduces xerostomia during head and neck radiation therapy. However it requires intravenous drug administration.

Dental caries:

Decreased flow of saliva generally results in aggressive dental caries. One of the most effective methods of treating this condition is through the daily use of tropical applications of fluoride [5]. Both stannous and sodium fluoride have been used in a variety of forms[3] with significant success. One additional advantage of stannous fluoride is that it has an antimicrobial effect, reducing ***s. mutans*** counts. Sodium fluoride, [3, 5] because of its higher pH, is less irritating to the compromised soft tissue and is substituted for the stannous form for patients who complain of a burning sensation when using the stannous gel. Gels used with the tray cover all tooth surfaces than either fluoride rinses or gels applied with a brush. Some authors have proposed that the use of a tray as a carrier simplifies the fluoride application procedure and improves patient compliance, achieving a better overall effect[3, 5.]

Clinical experience has demonstrated that discontinuing the fluoride application, even for short period of time, may result in renewed cariogenic activity.

Trismus & fibrosis:

Trismus may begin shortly after radiation begins. Patients suffering with tumours of the palate, nasopharynx, and maxillary sinus are most likely to develop trismus. If unmanaged, trismus makes eating difficult and various dental clinical procedures almost impossible. The primary treatment is essentially to exercise the muscles involved. Bite openers or exercise devices like tongue blades are provided to the patients. Improvement is generally short-lived and reappears over a period of even a few hours. Therefore, exercising at regular time intervals is mandatory to avoid the severity of trismus.

Chronic trismus gradually converts into fibrosis of the muscles and at this late stage, stretching of muscle is not favoured as a solution. Exercise must begin early in treatment regimen.

Shielding and positioning stents[14]

To minimise the morbidity & its effects on the soft tissues associated with radiotherapy stents are used.These are mainly of two types-

I. Positioning stents[14;]

These stents lower the tongue and keep the mandible and maxilla in an open position. Maxillary structures such as palate, upper gingiva, and buccal mucosa are therefore spared of radiation hazards.

II. Shielding stents[14;]

It is used to protect uninvolved adjacent structures when electron beam therapy is given. It is known that 1 cm thickness of a Lipowitz alloy (Cerro bend, Cero metal Products, Bellefort, PA) .It is a eutectic alloy of 50% bismuth, 26.7% lead, 13.3% tin, and 10% cadmium by weight. The lead effectively reduces an 18 Mev electron beam by approximately 95%. The metal is only effective, however when electrons are used.

Post radiation phase: Maintenance of oral hygiene

Acute mucositis & loss of taste will subside gradually over a period of 6-8 weeks. The length of time necessary for recovery is dependent on the severity of damage to the soft tissue (may take months to recover). The loss of salivary function is permanent, and salivary flow rates have been proved to decrease with time. As a result, oral tissues will remain dry and uncomfortable. So the patient has to maintain meticulous oral hygiene, with daily rinsing mouthwashes and regular use of salivary substitutes[13.] Daily topical application of fluoride is done to restrict the cariogenic activity. Tooth decay leading to pulpal pathosis can be a serious problem in the radiated patient since extraction of the involved teeth is a complicated undertaking.

Candidiasis:
During or following radiation, most common infection is due to candida albicans .This results in generalised inflammation involving the palate & cheeks. The irradiated tissue may exhibit some erythema but lack whitish patches generally associated with candida.

Management:-

a) Clotrimazole or nystatin rinses are prescribed if culture test is positive along with appropriate antibiotics in case of bacterial infection.

b) Meticulous oral hygiene and frequent rinsing with salt and soda or diluted solution of water.

c) Candida may be harboured in or on the surface of dentures or obturators and play a role in chronic reinfection. Soaking prostheses in an antifungal solution or dilute hypochlorite for complete dentures have proven to be effective preventive measures.

Trismus & fibrosis:

Trismus and fibrosis will continue following radiation therapy which will increase in severity with time. This condition will only improve with constant exercise regimen[20.] Exercise should be performed deliberately at regular intervals followed by periods of rest[14, 20.] The more frequent and diligent the exercise regimen, the more beneficial the result.

Osteoradionecrosis:

Osteoradionecrosis (ORN) [4] is a condition of nonvital bone in the site of radiation injury. ORN can be spontaneous, but it most commonly results from tissue injury. The cause is related to the hypovascular, hypocellular, and hypoxic conditions that exist in bone following radiation. The main contributing factors are trauma, type of radiation, dosage & tissue volume involved. ORN is more common in the mandible than in maxilla[4.]

Management:-

Initial treatment should always be conservative. The lesion should be carefully cleansed and any small, sequestered bony fragments are carefully removed[17.] Oral hygiene procedures are reviewed and the patient is asked to rinse frequently with dilute hydrogen peroxide or a salt and soda solution in an effort to keep the area moist and clean[17.] Dentures are relieved over the affected area and soft plastic mouth guards have also been used as protective devices. Topical packing of the area with zinc oxide or various antibiotics has been recommended[15, 17.] Following initial treatment frequent visit at regular intervals to a dentist is recommended. When sequestra are evident, they may be judiciously removed and the areas kept smooth to avoid irritation to surrounding tissues. The dentist must be aware that these relatively asymptomatic lesions will take an

extended period of time to heal.

If the conservative treatment does not work the patient is referred for hyperbaric oxygen therapy[17]. In 1983, Marx demonstrated successful resolution of mandibular ORN in 58 patients using a staged protocol with HBO and surgery. Substantial portions of the mandible may be removed leading to discontinuity defects. Mandibular reconstruction using micro vascular surgical techniques may be necessary to restore patient function. Hyperbaric oxygen has proven to be an effective method of managing the patient with ORN[17], solving a difficult, frustrating problem.

Post- radiation prosthodontic care:

Patient treated with radiotherapy suffer substantial changes to the oral mucosa and are often require new complete or partial dentures. Ideally, the oral soft tissue must be adequately healed before necessary prosthodontic procedures can be initiated[18]. There are suggestions that a latent period of at least 6 months to one year should be provided[18]. However, the ultimate treatment plan depends upon the clinician who takes into account all the factors.

Dental extractions:

A conservative approach is advised in regard to extraction of teeth after radiation[10]. Extraction should only be considered after careful evaluation. Extremely mobile, periodontally compromised teeth can be safely removed with minimal risk of developing ORN. In situations involving single tooth, endodontics should be considered as an alternative approach even when the tooth is considered nonrestorable. Teeth located in areas not included in the radiation fields can be extracted safely.

Conclusion:

The cancer patient who is to receive or has received curative doses of radiation to the head and neck presents a challenge for the dentist. The importance of patient compliance should be emphasized. The dentist has to take a huge challenge because treatment provided in this stage can have life long effects. They must also have an understanding of basic radiation and dental oncology techniques and their own limitations but need not be trained specialists to justify their involvement in the management of oral health of this unique group of patients. In most instances, routine dental treatment provided by the patient's general dentist in a prudent way is satisfactory enough.

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