

# Effects of Radiation on Oral Cavity : A Review

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## INTRODUCTION

During the last decade, there is large improvement in the treatment of head and neck cancer, and radiotherapy is currently used in treatment.<sup>1</sup> It shows better results in comparison with surgical procedures, since radiotherapy can be used as curative, adjuvant, neo-adjuvant and palliative type of treatment. It is also used in conservative approaches, with protocols that preserve organs and tissues. Ionizing radiation is corpuscular or electromagnetic wave that carries energy. When energy interacts with tissues, it causes the movement of electrons that ionizes the chemical environment and produce effects such as water hydrolysis and DNA modification.

Although, new techniques such as intense modulated radio-therapy (IMRT) came into existence, there still occur changes in the salivary gland structures and salivary properties due to radio-sensitivity of salivary gland. Another multifactorial complication that

occurs after radiation includes changes in oral micro-flora and possible hard tissue alterations, radiation related dental caries.

The aim of this article is to review the effects of radiation on oral cavity as the radiotherapy is the common treatment for head and neck cancers.

## Effects on Salivary Glands

Salivary glands are the major oral tissue that shows side effects while interacting with radiation. Salivary glands are radiosensitive due to low mitotic rate and as they receive secondary doses from the radiations directed to head and neck tumors.<sup>2</sup> The mechanism of destruction of salivary gland by ionizing radiation is exactly not known though it is well known that, radiation causes damage to the salivary gland. Mucous acini is less radiosensitive than serous acini. Mucous acini is retained intact,

while serous were modified after the fractionated dose of radiotherapy.

Both qualitative and quantitative changes in the saliva occur. There will be change in the anti-bacterial property, alternation in the oral micro-flora, reduction in buffer capacity, decrease in the salivary pH and increase in salivary viscosity. There will be imbalance between demineralization /re-mineralization system and the equation moves to demineralization side as a result of reduction in pH and buffer capacity. An immunological and protein deficit and an increase in cariogenic and acidogenic bacteria occur by xerostomia caused by radiotherapy.

### Oral Mucositis

Oral mucositis is a quick response of the oral mucosa to the ionizing radiation. It is an inflammatory reaction of mucous membrane due to loss of squamous epithelial cells by mitotic death of basal keratinocytes, which may be seen in the pharyngeal, esophageal, laryngeal areas and in the oral cavity. It is multifactorial inflammation which is painful and usually appears in the beginning of head and neck radiotherapy and continuous till the third week after the treatment.<sup>4</sup> It is not caused by any infectious agent. It may be caused by the secondary microbial colonization in the lesions resulting in a systemic or local infection that can exacerbate mucositis.

Distortion or the decreased sense of taste, pain, dysphagia, odynophagia, pain which are the symptoms of oral mucositis can lead to nutritional deficiency. Oral mucositis can cause indirect changes in the oral cavity like impaired oral hygiene, changes in the oral flora, decreased buffering capacity of saliva, changes in diet can increase the risk for caries and periodontal diseases.<sup>3</sup>

### Oral mucositis can be further graded into four types:

GRADE 1: A white discoloration of oral mucosa is seen initially which is due to hyper-

keratinization of epithelium and is followed by erythema, which is usually asymptomatic.

- GRADE 2: Small foci of ulceration are seen around the third week of radiation therapy.
- GRADE 3: Pseudo-membranes are formed over the ulcer affecting large areas of the oral mucosa.
- GRADE 4: Severe ulceration covering all the mucosal surface with severe pain.

### RADIATION INDUCED DENTAL CARIES

The ameloblast cells are less sensitive than odontoblast to ionizing radiation, with regard to radio sensitivity of dental cells.<sup>5</sup> The area affected by the radiation, dose of the radiation, organic and mineral content of the tooth structure determines the extension and severity of the damage caused by radiation.

Clinically, three different patterns have been identified,

- Type 1: Most common pattern affecting the cervical aspect of the teeth and extending into the CEJ.
- Type 2: An area of demineralization on all dental surfaces. Generalized erosions and worn out occlusal and incisal surfaces are also seen.
- Type 3: Seen as a change in the color of the dentin. It is the least common type. The crown appears dark brown-black and occlusal and incisal wear can be seen.

The lesion on the enamel appears as a diffuse brown discoloration with rapid progression without severe pain. Radiation induced decay occur at the dentino-enamel junction, cusp, incisal, and cervical areas, while, typical dental caries occur in fissures. Radiation induced caries will be having similar demineralization pattern and morphological pattern when compared with normal caries. It is clinically observed that severe lesion occurs with higher radiation dose. Patients undergoing radiotherapy are the only ones affected with radiation induced dental caries. Radiation therapy can also cause changes in the salivary gland,

oral mucositis, diet changes and decrease in the standard of the oral hygiene are important factors for the onset of multifactorial disease.

## CONCLUSION

Xerostomia, oral mucositis, changes in the salivary gland structures are some of the well-known effects of radiation on oral cavity. Radiation induced caries have a different behavior and clinical aspects even though, they have same pattern of evolution. Effects of ionizing radiation, hygiene, and dietary changes in the oncologic patients are the common factors in radiation induced caries. With the increase in the survival of patients with head and neck cancer, proper management of oral toxicities are to be maintained in order to ensure the long term oral health of the patient.

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