EFFECTS OF RADIATION ON ORAL CAVITY

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RADIATION EFFECTS ON ORAL TISSUES

• The oral cavity is irradiated during the course of treating radiosensitive oral malignant tumors, usually squamous cell carcinomas.

• The deterministic effects of a course of radiotherapy on normal tissues of oral cavity can be described as:

  * **Oral Mucous Membrane:**
    • Contains a basal layer composed of radiosensitive vegetative and differentiating intermitotic cells
    • Near the end of the second week of therapy- areas of redness and inflammation (mucositis) seen.
    • Irradiated mucous membrane begins to break down with the formation of a white to yellow pseudomembrane.

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• Mucositis is most severe at end of therapy.
• After irradiation is completed, the mucosa begins to heal rapidly. Healing is usually complete by about 2 months.
• Long-term atrophy results from progressive obliteration of the fine vasculature and fibrosis of the underlying connective tissue.
• Oral ulcerations of the compromised tissue can also result from a denture sore, radiation, tumour recurrence.
• Secondary yeast infection by Candida albicans is a common complication.
MUCOSITIS

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TREATMENT AND PREVENTION

- Good oral Hygiene minimizes changes of secondary infection by candida.
- Topical anaesthetics may be required at mealtime.

**Taste Buds**
- sensitive to radiation
- extensive degeneration of the normal histologic architecture of taste buds.
- **loss of taste acuity during the second or third week of radiotherapy**
- Bitter and acid flavours are more severely affected when the posterior two thirds of the tongue is irradiated,

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salt and sweet flavours affected when the anterior third of the tongue is irradiated.

Alterations in the saliva may also be a possible cause of reduction in taste acuity during course of therapy.

Recovery usually occurs in 60 to 120 days after irradiation.

**Salivary glands**

The parenchymal component of the salivary glands is radiosensitive (parotid glands more so than submandibular or sublingual glands).

A marked and progressive loss of salivary secretion is usually seen in the first few weeks after initiation of radiotherapy.

The extent of reduced flow is dose-dependent and reaches essentially zero at 60 Gy.
• The mouth becomes dry (xerostomia) and tender.
• Swallowing is difficult and painful because the residual saliva also loses its normal lubricating properties.
• **pH value** of saliva of an irradiated patient is 1 unit below normal (i.e., an average of 5.5).
• **Buffering capacity of saliva falls as much as 44%** during radiation therapy.
• If some portions of the major salivary glands have been spared, dryness of the mouth usually subsides in 6 to 12 months because of compensatory hypertrophy of residual salivary gland tissue.

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• Reduced salivary flow that persists beyond a year is unlikely to show significant recovery.
• Salivary changes have a profound influence on the oral microflora and secondarily on the dentition, often leading to radiation caries.

**Teeth**
• Irradiation of teeth with therapeutic doses during their development severely retards their growth.
• If it precedes calcification, irradiation may destroy the tooth bud.
• Adult teeth are very resistant to the direct effects of radiation exposure.
• The severity of the damage is dose-dependent
Irradiation of teeth may retard or abort root formation, but the eruptive mechanism of teeth is relatively radiation-resistant.

Pulpal tissue demonstrates long-term fibroatrophy after irradiation.

Radiation has no discernible effect on the crystalline structure of enamel, dentin, or cementum, and radiation does not increase their solubility.

**Radiation Caries**

Radiation caries is a rampant form of dental decay that may occur in individuals who receive a course of radiotherapy that includes exposure of the salivary glands.

These are a result of changes in salivary glands and saliva.
Clinically, **three types** of radiation caries exists:

- **Widespread superficial lesions** - attacking buccal, occlusal, incisal, and palatal surfaces. It is the most common type.
- **Lesions affecting primarily the cementum and dentin in the cervical region**. These lesions may progress around the teeth circumferentially and result in loss of the crown.
- **Lesions appearing as a dark pigmentation of the entire crown**. The incisal edges may be markedly worn.

Some patients develop combinations of all these lesions.

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Retarded root development

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Radiation caries

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TREATMENT AND PREVENTION

• The best method of reducing radiation caries is daily application for 5 minutes of a viscous topical 1% neutral sodium fluoride gel in custom-made applicator trays.

• The best result is achieved from a combination of restorative dental procedures, excellent oral hygiene, and topical applications of sodium fluoride.

• Teeth with gross caries or periodontal involvement are often extracted before irradiation.

Bone

• The primary damage to mature bone results from radiation-induced damage to the vasculature of the periosteum and cortical bone.

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RADIATION EFFECT ON BONE

• Radiation acts by destroying osteoblasts and, to a lesser extent, osteoclasts.

• Normal marrow may be replaced with fatty marrow and fibrous connective tissue. The marrow tissue becomes hypovascular, hypoxic, and hypocellular.

• The endosteum becomes atrophic, showing a lack of osteoblastic and osteoclastic activity.

• The degree of mineralization may be reduced, leading to brittleness, or little altered from normal bone.

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Osteoradionecrosis

- It is the most serious clinical complication that occurs in bone after irradiation.
- This bone infection may result from
  - radiation-induced breakdown of the oral mucous membrane
  - by mechanical damage to the weakened oral mucous membrane such as from a denture sore or tooth extraction, through a periodontal lesion, or from radiation caries.

SITE:
- **Mandible more commonly affected**, probably due to decreased vascularity of the mandible, especially the posterior body of mandible.

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CLINICAL FINDINGS:

- Loss of mucosal covering and exposure of bone is the hallmark of osteoradionecrosis.
- Pathologic fracture also may occur.
- The exposed bone becomes necrotic as a result of loss of vascularity from the periosteum and subsequently sequestrates, often leading to exposure of more bone.
- Intense pain may occur, with intermittent swelling and drainage extraorally.

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RADIOGRAPHIC FEATURES

- CT is the imaging modality of choice.
- The radiographic features of osteoradionecrosis have many similarities to those of chronic osteomyelitis.
- Location-The mandible, especially the posterior mandible.
- Periphery-The periphery is ill defined and similar to that in osteomyelitis.
- Internal structure-The affected bone is sclerotic or radiopaque in appearance. This is very similar to chronic osteomyelitis. The bone pattern is granular. Scattered regions of radiolucency may be seen, with and without central sequestra.
- Effects on surrounding structures-Inflammatory periosteal new bone formation is uncommon. The most common effect on the surrounding bone is the stimulation of sclerosis.

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MANAGEMENT

• The treatment of osteoradionecrosis currently is unsatisfactory.

• **Decortication with sequestrectomy and hyperbaric oxygen with antibiotics** have shown limited success because of poor healing after surgery.

• Conservative approaches with the aim of therapy to maintain the integrity of the lower border of the mandible and to keep the site free of infection and the patient free of pain may in the long term prove more successful.

• Removal of teeth that have significant periodontal disease or have a poor prognosis before radiation treatment and excellent oral and denture hygiene are the mainstays of preventive treatment.

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