Xerostomia Induced by Radiotherapy: A Review

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Abstract

Xerostomia, or dry mouth, is a common and distressing side effect of radiotherapy in patients with head and neck cancer. Radiation therapy, while effective in tumour control, inadvertently damages salivary gland tissues, leading to reduced salivary flow and altered composition. This article reviews the anatomy and physiology of salivary glands, mechanisms of radiation-induced glandular dysfunction, clinical implications, and contemporary preventive and therapeutic strategies.

Keywords: Xerostomia, Radiotherapy, Salivary gland dysfunction, Head and neck cancer, Radiation-induced oral complications

INTRODUCTION

The oral cavity hosts complex protective mechanisms, with saliva playing a central role in lubrication, digestion, taste perception, and immune defense. Saliva is secreted by major and minor salivary glands, comprising serous and mucous acini that produce various bioactive components. Radiotherapy to the head and neck often leads to irreversible damage to these glands, resulting in xerostomia and its associated complications such as caries, mucositis, and oral infections.[1,3]

Structure and Function of Salivary Glands

The major salivary glands include the parotid, submandibular, and sublingual glands. These glands produce over 90% of total saliva. The parotid secretes serous fluid rich in amylase, while the submandibular and sublingual glands produce mixed and mucous secretions, respectively. Saliva facilitates mastication, swallowing, speech, antimicrobial defense, and tissue repair.[4,6]

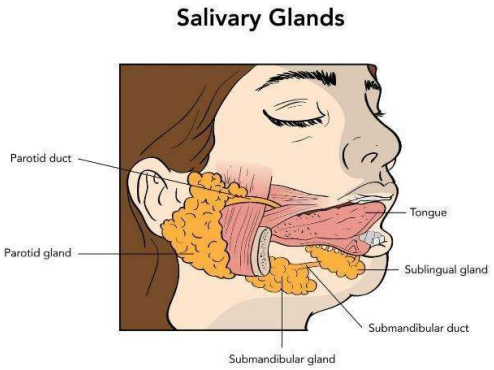

Figure 1: Salivary Gland

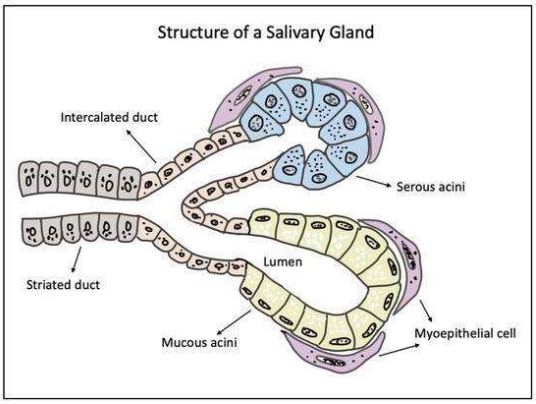

Figure 2: Internal structure of Salivary Gland

Pathophysiology of Radiation-Induced Salivary Dysfunction

Radiation affects salivary glands through several mechanisms including direct cellular damage, stem cell depletion, vascular injury, inflammatory fibrosis, oxidative stress, and neural impairment. These lead to progressive destruction of acinar cells, replacement with fibrous tissue, ischemia, and loss of regenerative potential, ultimately resulting in chronic salivary dysfunction.

Clinical Manifestations

Xerostomia presents with oral dryness, burning sensation, difficulty in chewing, swallowing, and speaking, along with altered taste perception. Patients are more prone to dental caries, periodontal disease, oral candidiasis, and fissuring of lips and tongue. These complications compromise nutrition, oral hygiene, and psychosocial well-being, making xerostomia a significant quality-of-life issue.[3]

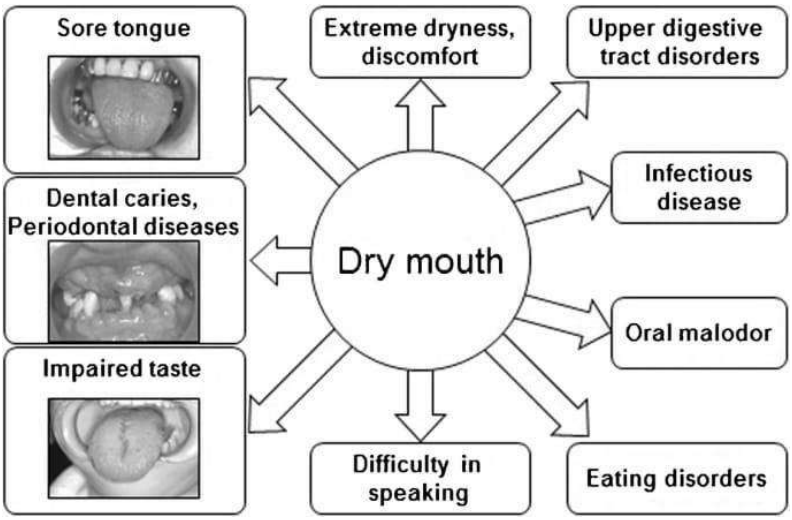

Figure 3: Symptoms of Xerostomia

Mechanism of Radiation-Induced Xerostomia

Radiation-induced xerostomia progresses through different phases. The initial phase involves water depletion with intact acinar structures. The latent phase brings about membrane degradation, followed by late-phase cell death and fibrosis. The chronic phase is characterized by irreversible glandular and neural damage, resulting in long-term xerostomia with limited regeneration.[5]

Prevention of Xerostomia

Preventive measures include the use of radioprotective agents such as Amifostine and botulinum toxin before radiotherapy. Modern radiotherapy techniques like IMRT and proton therapy minimize gland damage, while surgical submandibular gland transfer offers additional protection. Post-therapy strategies under investigation include stem cell and gene therapies, while supportive measures such as sialagogues, saliva substitutes, and hydration remain crucial.[7]

Treatment Approaches

Management of xerostomia relies on both pharmacological and supportive measures. Cholinergic agonists such as pilocarpine and cevimeline stimulate residual gland activity. Saliva substitutes, topical agents like malic acid sprays, and sugar-free chewing gums offer symptomatic relief. Fluoride therapy remains important to prevent dental caries, and newer regenerative strategies including gene-modified therapies show promise for the future. CMC-based gels and sprays for moisture.[9]

CONCLUSION

Xerostomia is a common, debilitating complication of head and neck radiotherapy. Advances in radiation planning, radioprotective agents, and regenerative therapies show promise in preserving salivary function. Multidisciplinary efforts involving oncologists, dentists, and researchers are essential for the comprehensive care and improved quality of life in affected patients.

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