

NOVEL RADIATION BARRIER DEVICE FOR ORAL CANCER PATIENTS WITH LIMITED MOUTH OPENING: A CASE REPORT

Dr. Soumya Raj¹, Dr. Manoj Shetty^{2*}

¹ Post graduate Student, Department of Prosthodontics and Crown & Bridge, A B Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Mangaluru, 575018, India

² Professor and HOD, Department of Oral Implantology, A B Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Mangaluru, 575018, India

*Corresponding Author

Dr. Manoj Shetty²

Email: drmanojshetty@nitte.edu.in

Abstract-

This case report discusses the development and application of a novel radiation barrier device designed to enhance the effectiveness and safety of radiation therapy for oral cancer patients experiencing trismus (limited mouth opening). The report presents two clinical cases, highlighting the challenges faced and the innovative solutions implemented to protect healthy tissues during radiation treatment.

Keywords: oral cancer, radiation therapy, custom barrier devices, squamous cell carcinoma, trismus.

Introduction: Oral cancer remains a significant global health issue, with India experiencing a high prevalence due to factors like tobacco use, betel quid chewing, and alcohol consumption. Commonly affecting the tongue, floor of the mouth, and palate, it greatly diminishes patients' quality of life, leading to challenges such as difficulty in swallowing, speech impairment, and persistent pain.

Treatment options typically include surgery, chemotherapy, and radiotherapy, with radiotherapy being essential for addressing residual cancer cells.

Radiotherapy (RT) has been an established modality for managing head and neck cancers, aiming to effectively treat the malignancy while preserving organ functionality [1]. External beam radiation therapy (EBRT) is utilized as a standalone definitive treatment, in conjunction with chemotherapy, or as an adjuvant therapy following surgical tumor resection [2]. Recent advancements in technology and alternative therapeutic strategies have focused on personalizing radiation dose delivery and refining target volume delineation to enhance therapeutic outcomes while minimizing adverse effects. [3].

Trismus in oral cancer is defined as a tonic contraction of the muscles of mastication resulting from any abnormal condition or disease with mouth opening of ≤ 35 mm.[5] It may be a result of tumour growth, infection, surgery or radiation. Occurrence of trismus complicate the delivery of radiation, risking damage to

healthy tissues. To assist in the treatment delivery to patients undergoing radiotherapy dental clinicians can fabricate positioning stents. Positioning stents or Intraoral radiation stents (IRS) are prosthetic devices that assist in the effective delivery of radiation to tumor tissues and aim to avoid unnecessary radiation to adjacent healthy tissues thus limiting post-radiotherapy toxicities. They are used to protect or displace vital structures, assist in positioning of the treatment beam for effective administration of radiotherapy, carry a radioactive material, shield healthy tissues of the oral cavity, and/or maintain the desired mouth opening during radiotherapy.

This case report describes the use of positioning stents fabricated using thermoplastic sheets with a bite block in patients undergoing radiation therapy for oral cancer and their effectiveness in reducing the dosage of radiation to the adjacent vital tissues thus aiding in improving the overall quality of life of the patient.

Case 1:



Patient Information: A 62 year old patient presented to the department of oncology with a well differentiated mucoepidermoid carcinoma of the retromolar trigone extending to the tongue. The patient

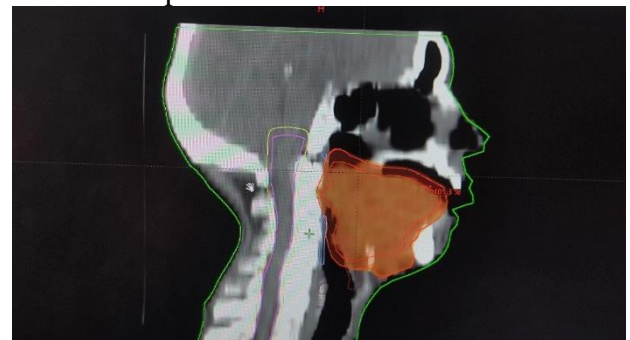
presented with grade III trismus (mouth opening of 11 mm) significantly limiting mouth opening, complicating the placement of conventional bite blocks for radiation therapy. The treatment plan proposed for the patient was palliative therapy

Device Development: A custom device was created by pressing a sheet to act as a barrier, protecting surrounding healthy oral tissues from unnecessary radiation exposure. This innovative solution allowed for safe and effective radiation therapy administration.



Results:

The mean radiation dose to surrounding tissues was reduced from over 30 Gy to 24Gy, demonstrating a 25% reduction in radiation exposure.



Case 2:



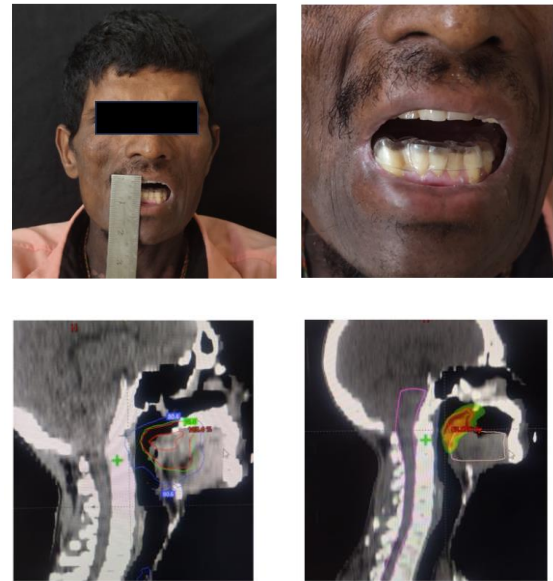
Patient Information: A 46 year old patient presented to the department of oncology with a Well-differentiated squamous cell carcinoma of the hard palate, extending into the soft palate. The patient presented with grade III trismus (mouth opening of 10 mm) The limited mouth opening posed significant challenges, as the tongue was in contact with the lesion site on the palate. The treatment plan proposed for the patient was radiotherapy and surgical therapy.

Device Development: A mandibular impression was taken, and the tongue area was modified using modeling wax. A plastic sheet was pressed to create a barrier that compressed the tongue, preserving healthy tissue during radiation therapy.



Results: The patient underwent radiation therapy of 70 Gy over 35 fractions. The mean radiation dose to normal tissues was

reduced from 70 Gy to 35 Gy, achieving a 50% reduction in exposure.



Discussion: Through mouth opening, tongue depression, and tongue deviation, positioning stents are utilized to move and shield normal tissues such as the lips, tongue, buccal mucosa, and soft palate from the high dosage radiation field. These placement stents can also be utilized to confine the implicated mandible within the radiation field, raise the jaws' vertical height, or move the mandible out of the radiation field. Positioning the tongue or mandible away from the radiation source may help reduce mucositis, which can otherwise result in delayed osteoradionecrosis, poor nutrition, and weight loss.

The cases presented demonstrate the effectiveness of the novel radiation barrier devices in protecting healthy tissues while allowing for precise radiation delivery. The innovative solutions developed in prosthodontics address the complex challenges faced by oral cancer patients with limited mouth opening, ultimately improving treatment outcomes and quality of life.

Conclusion: In order to meet patient-specific treatment goals, the radiation oncology team and the oral health care practitioner should both have a thorough

understanding of the clinical application of IRS for head and neck tumors. In order to improve the immediate and long-term quality of life for patients with head and neck cancer receiving radiation therapy, general dentists and maxillofacial prosthodontists can work as members of a multidisciplinary team to help fabricate these straightforward yet practical prosthetic devices. The safety and effectiveness of radiation therapy have been significantly improved by the specially designed radiation barrier devices created for these patients. These incidents highlight how crucial prosthodontic innovation is to addressing clinical issues and enhancing patient care.

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