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Validity Of Oral Prosthetic Stents In Maxillofacial Cancer During Radiation Therapy: A Case Report

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Abstract
This report describes the application of a customized mold for high-dose-rate (HDR) brachytherapy in the treatment of stage two squamous cell carcinoma (SCC) of the soft palate. The method led to effective local control of the tumor along with excellent aesthetic and functional preservation. To enhance the precision of radiation delivery and safeguard adjacent normal tissues, specially designed stents incorporating both tissue-equivalent bolus material were utilized. The successful outcome was largely attributed to the close collaboration among the surgical, radiation oncology, and prosthodontic teams, which also played a key role in minimizing post-treatment complications.

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I. Introduction

Radiation-induced toxicities and their management continue to pose a significant clinical challenge in the treatment of head and neck cancers. Radiation oncologists carefully design and deliver ionizing radiation fields to maximize the therapeutic dose to target tumor tissues while minimizing exposure and subsequent toxicities to the surrounding healthy normal tissues. The aim of this approach is to minimize acute and chronic toxicities, including but not limited to mucositis, dysgeusia, dysphagia, xerostomia, progressive loss of periodontal attachment, radiation-induced hyposalivation and subsequent risk for dental caries, trismus, and osteoradionecrosis of the jaws.[1] These toxicities are a result primarily of DNA and small vessel damage caused by the ionizing radiation in normal tissues located within the radiation field. The resultant cellular damage is directly proportional to the amount of ionizing radiation deposited to a volume of tissue.[2]Conventional head and neck cancer radiation treatment uses various types of ionizing radiation including electron or photon (X-rays or gamma rays) beams. More contemporary conformal radiation techniques can use charged particle beams (protons and carbon ions).[3] The primary delivery techniques for head and neck radiotherapy include volumetric arc therapy (VMAT), image-guided radiotherapy (IGRT), intensity-modulated photon radiation therapy (IMRT), three-dimensional conformal radiation therapy (3D-CRT), brachytherapy (also referred to as interstitial radiotherapy), and orthovoltage or superficial radiation therapy.

Depending on the anatomical location of the radiation target, it may be necessary to fabricate an intraoral radiation stent (IRS) for use during treatment. The primary purposes of an IRS include displacing normal tissues and vital structures (uninvolved by the tumor) away from the radiation field, aiding in precise positioning of the treatment beam for effective radiotherapy delivery, or carrying radioactive materials to the target site—thereby minimizing radiation exposure to healthy tissues. Additionally, IRS devices help immobilize the mandible and tongue, ensuring consistent patient positioning and jaw separation during both planning and subsequent radiation sessions. Oral health professionals, such as general dentists and maxillofacial prosthodontists, play an important role in providing these supportive services by fabricating IRS devices as recommended by the radiation

oncologist. The use of an IRS helps protect uninvolved tissues by taking advantage of the Inverse Square Law, where the intensity of radiation exposure decreases with the square of the distance from the source. Thus, increasing the distance between healthy mucosa and the radiation beam reduces the severity of radiation-induced reactions. Based on their intended function, radiation prostheses can be broadly classified into three types: (1) shielding prostheses, (2) radiation carriers, and (3) positioning stents.

II. Case Report

Case I. lip carcinoma stents

A 65-year-old male patient diagnosed with squamous cell carcinoma of the soft palate, staged as T2-N2c-M0 (Figure 1), was referred by the radiotherapist for further management. A treatment plan was established for serial concurrent chemoradiation therapy (CCRT), involving intensity-modulated radiation therapy (IMRT) delivering a total dose of 7,000 Gray to the soft palate over a period of six weeks. Prior to the initiation of radiotherapy, a dental impression was taken using alginate material (Figure 2), and a cast was subsequently retrieved (Figure 3). After blocking out the necessary areas, a mold was fabricated on the cast and trial done in patient's mouth (Figure 4). . Stents were incorporated in Mold for brachytherapy (Figure 5), and to enhance the radiation dose delivery to the targeted lesion area and follow up the patient after 1 year to check the healing (Figure 6). In the present case, a tissue-equivalent mold material was used, exhibiting radiation absorption properties similar to those of soft tissues in the body. At the one-year follow-up, the radiotherapy outcome was successful, with stable healing observed at the target site on the soft palate.

Figure 1. Pre-Radiotherapy State Of Soft Palate In 65-Year-Old Male Patient

Figure 2. Impression Was Made Of The Soft Palate

Figure 3. Cast Were Poured

Figure 4. Mold Was Placed On Soft Palate

Figure 5. Stents Were Incorporated In Mold For Brachytherapy

III. Discussion

While radiotherapy (RT) is effective in controlling oral and maxillofacial neoplasms, it often results in unavoidable morbidity to surrounding normal tissues post-irradiation. Although the need for an oral radiation stent is typically determined by the attending radiation oncologist, it is also a key concern for the prosthodontist, who will be responsible for future dental rehabilitation.

Tissue bolus stents are particularly useful in treating superficial lesions with irregular contours. In Case I, for example, irregularities in the lesion of the soft palate may lead to uneven radiation exposure—some areas may be undertreated, while others may receive excessive doses, creating hotspots. In this case, a tissue-equivalent, calibrated surface gel was used to compensate for surface irregularities and align the radiation beam perpendicularly to its central axis. This approach helped achieve a more accurate and homogenous distribution of radiation.

Commonly used materials for bolus construction include tissue conditioners, water, saline, waxes, and acrylic resins. Prior to delivering the stent, it is essential to assess the patient's tolerance and comfort, especially given the increased inter-occlusal height and the bulky sensation it may cause. The stent should be designed to be as physiologic and comfortable as possible to ensure patient compliance.

IV. Conclusion

Oral complications related to radiotherapy can be effectively managed using customized intraoral stents provided by a prosthodontist. A multidisciplinary team approach, involving multiple specialists, should be established prior to the initiation of surgery or radiotherapy. These collaborative efforts can help ensure a smoother post-radiotherapy recovery and simplify future treatment planning, including dental care.

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