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ORIGINAL ARTICLE

Preventive Prosthodontics for Head and Neck Radiotherapy

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ABSTRACT

Adverse tissue reactions associated with the use of radiotherapy in the management of patients with head and neck cancer are painful and they diminish the quality of life, often discouraging the patient from taking treatment. Customized intraoral stents can help prevent the unnecessary irradiation of the surrounding normal tissues, thus reducing the severity of reactions. Since the use of these stents is individualized, close collaboration between the radiotherapist and the prosthodontist is essential. However, when properly designed and used, these stents are effective in reducing the treatment morbidity.

Key Words: , Radiation stents, radiotherapy complications, head and neck cancer

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Introduction

In India, around 40% of the cancers detected are oral cancers. In addition to this, there are patients with cancer of the nose, nasopharynx, paranasal sinuses and the oropharynx, where treatment involves the oral cavity as well as the head and neck area. Radiotherapy is increasingly being used as an adjunctive form of treatment in the management of head and neck cancer .Radiation therapy is defined as "the therapeutic use of ionizing radiation in the management of neoplasms of the body without surgery, or as an adjunctive palliative treatment after surgery, either in combination with or without chemotherapy" [1].

The two main categories of ionizing radiations which are used are electromagnetic radiations (photons, x-rays, gamma rays) and particulate radiations (electrons, neutrons and protons). The modality for radiotherapy which is used is external radiation therapy which is also called as teletherapy which is used to deliver high doses of radiation to tumours that are located within 6 cms of the skin surface. The doses are 6500 rads to 7500 rads for 6-7 weeks. Interstitial Radiotherapy, also called as Brachytherapy isused to deliver high doses (upto 20000 rads) of radiation over a short distance for a short time period (10-15 hrs). Radiation therapy is given in a series of treatments or fractions called fractionation. Unfortunately, this treatment causes complications by increasing the morbidity of the surrounding tissues. These include erythema, mucositis, ulcers, fungal infections, xerostomia, caries from decreased salivary flow and pH changes, possibilities of infection in the jaws or the potential for osteoradionecrosis from infection or trauma to irradiated bone . Hypersensitivity of the teeth, taste loss, oral bacterial shift and periodontal breakdown

are other problems of concern while treating the patient with radiotherapy [2],[3] Damage to the normal tissues can be reduced by using biological methods such as an appropriate method of radio therapy and by modifying the dose and fractionation regime. Various physical methods are also commonly used to reduce damage, which include shielding, proper positioning and the use of multiple fields.

As a preventive measure, radiotherapy protective devices/stents can be fabricated and used during the treatment. These devices are used to displace the position or to shield tissues or to assist in the efficient administration of radiotherapy to the affected areas, thus limiting the post therapy morbidity [4],[5],[6]. The need for a radiation stent is determined by the treating radiotherapist. The prosthodontist can actively help in the rehabilitation of cancer patients by fabricating a whole array of possible prostheses that can be constructed to meet specific patient needs, thereby limiting complications following therapy [7]. Radiation stents are commonly fabricated from acrylic resin and may or may not contain a shielding metal/alloy, depending upon several conditions; type of the radiation given, condition of the diseased hard and soft tissues, mouth opening ability and the needs of the treating radiotherapist. Conventional prosthetic techniques are used to fabricate these stents [8],[9] Silicone is the other material of choice. With the advancements in technology,,computer tomography is recently being used for the fabrication of brachytherapy carriers. Various types of radiation stents that can be fabricated are described here in brief.

Radiation Source Carriers

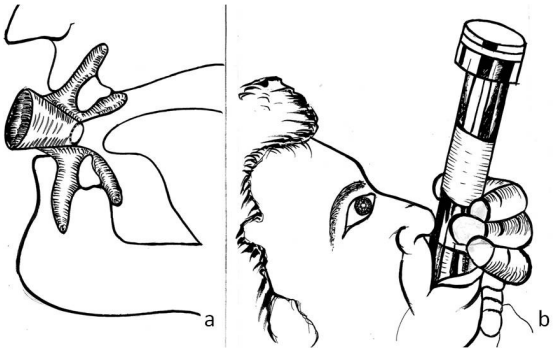
This type of prostheses is needed when radiation therapy is to be administered to confined areas by means of capsules, beads, tubes or needles of radiation emitting materials. The main purpose of these prostheses is to hold the radiation source securely in the same place during the entire period of treatment. It should be easy to load and unload. The exact location and the number of sources are determined by the radiotherapist and are marked on the dental model.They are used to carry the radiation sources close to the site of treatment (intracavitary) or directly into the tumour (interstitial) [10]. They are of two types; preloaded carriers and after loaded carriers. [Table/Fig 1].

(Table/Fig 1): Preloaded carriers

Perioral Cone Positioning Stents

This type of stent is commonly used when boosting the dose to the trauma site. It holds the cone in the repeatable and the exact position as desired by the radiotherapist, thus minimizing the chances of the movement of the cone during a particular treatment session. It is used in the treatment of superficial lesions involving the anterior floor of the mouth and the hard and soft palate. The actual cone or cylinder of the same diameter as the cones is used to form an acrylic resin ring of 5 to 6 cms long. Tin foil is wrapped around the cone as a separator from acrylic resin. In the presence

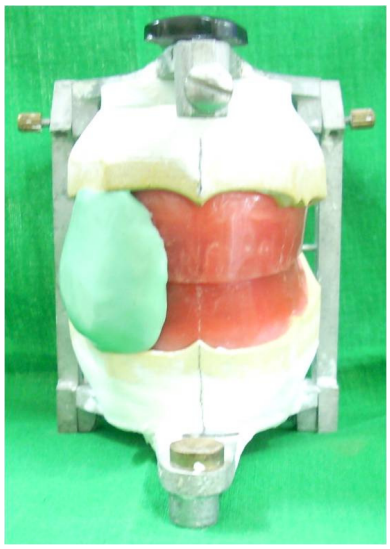
of a radiotherapist, the cylinder is attached to the maxillary record base (edentulous patient) or occlusal indices (dentulous patients) and the cone is centered over the lesion. The treatment cone is inserted into the positioning stent for verification of the position.[/Fig 2].



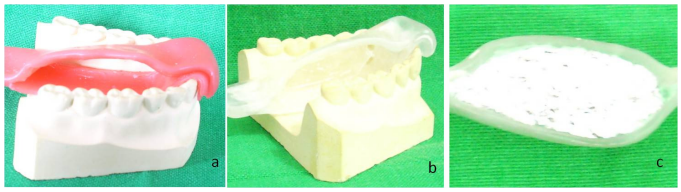
(Table/Fig 2): (a) Perioral cone positioning stent (b) Radiation cone positioning stent

Radiation Protection/ Shielding Stents

They are used to shield the vital structures which are adjacent to radiation therapy sites from excess dosage of radiation [Table/Fig 3]. When electron beam therapy is used to treat lesions of the buccal mucosa, skin or the alveolar ridge, mucositis is frequently observed in areas which are adjacent to the metallic dental restoration. The therapy beam scatters electrons from the high-Z metals used in the dental alloys, resulting in a local dose enhancement, which leads to excess dose in the surrounding tissues, thus causing mucositis. Effective shields can be fabricated to protect the tongue, salivary glands and the opposite side of the mandible [11]. Low melting alloys like Cerroband, Pb-Bi-Sn, and Lipowitz are used as shielding materials. Cerrobend alloy is preferred because of its low melting temperature and it effectively prevents the transmission of the electron beam. Maxillary and mandibular impressions are made, taking care to displace the tongue away on the side for which the stent is to be fitted, to create space between the tongue and the alveolar ridge. Casts are mounted in centric relation . A lingual extension of wax is made in the space created, which is hollowed out to create a cavity which is 1 cm thick. The wax pattern is acrylized, finished and polished. Cerrobend alloy is heated and poured into the hollow cavity and it is sealed with auto polymerizing resin to prevent back scatter dose enhancement [Table/Fig 4].



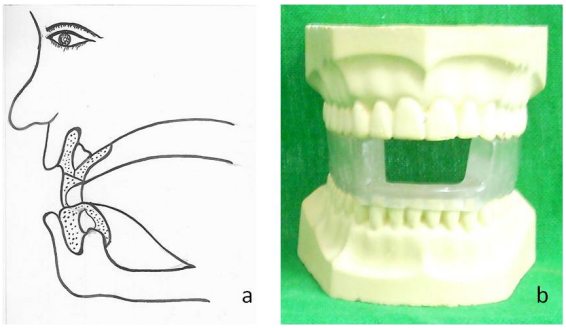
(Table/Fig 3) Shielding stent



(Table /Fig 4): (a). Outline of wax pattern for shielding stent. (b). Concavity into which cerrobend alloy is poured. (c) Stent with cerrobend in place.

Position Maintaining Stents

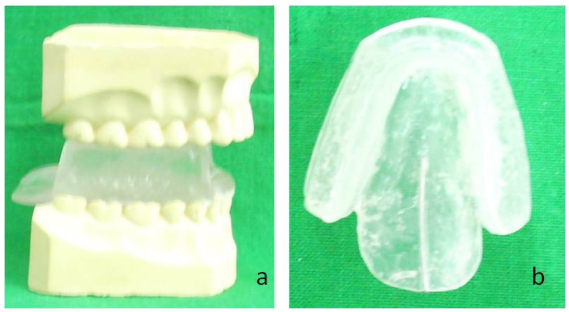
It is used to precisely position structures which are to be treated in fixed and repeatable positions for multiple treatment sessions. They are used to position movable structures like tongue, soft palate etc. [Table/Fig 5].



(Table/Fig 5): Position maintaining stent.

Tongue Depressing Stents

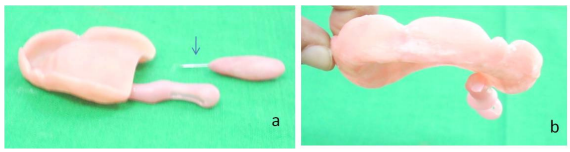
It is a custom made device which positions the mandible, depresses the tongue and spares the parotid gland during radiotherapy of head and neck tumours. These stents are more accurate and provide greater patient comfort than the commonly used "Cork and tongue blades". An interocclusal stent is prepared for the dentate patient, that extends lingually from both the alveolar ridges, with a flat plate of acrylic resin which serves to depress the tongue. A hole is made in the anterior segment in which the tip of the tongue is placed in order to establish a reproducible position. [Table/Fig 6].



(Table/Fig 6): Tongue depressing stent.

Dosimeter Positioning Stents

Dosimeter is a device which is used to calculate the amount of doses required for a lesion. These stents are designed with a series of slots for holding lithium fluoride capsules. Lithium fluoride capsules used as a dosimeter are an accurate and efficient means of determining dose locally. The lithium fluoride capsule is wrapped in a 0.1 inch tinfoil which is wrapped with acrylic resin casing and is allowed to cure. A hole is placed at one end of the stent and an orthodontic wire is used to push the capsule out of the acrylic resin casing. The resin case is attached to the stent in position as directed by the radiotherapist [Table/Fig 7].



(Table/Fig 7) Dosimeter positioning stent. (a) Lithium fluoride carrier attached to maxillary base. (b) Lithium fluoride carrier.

Tissue Recontouring Stents

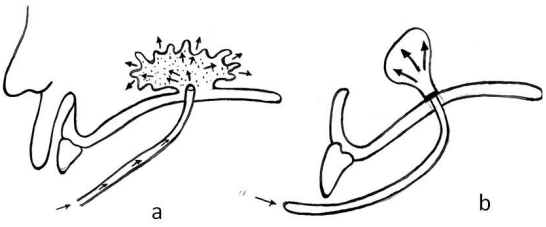
These stents are effective when treating skin lesions which are associated with lips when the beam is adjusted for midlines. Low doses are delivered at the corners of the mouth because of the curvature of the lips. A stent can be made to flatten the lip and the corner of the mouth, thereby placing the entire lip in the same plane. These stents are fabricated by modeling plastic and are processed in acrylic resin [Table/Fig 8].

(Table/Fig 8): Tissue recontouring stent.

Tissue Bolus Compensators/ Balloon Bolus Supporting Stents

These prostheses help in the treatment of superficial lesions of the face with irregular contours. Due to irregularities in the lesions,

some areas within the field may be untreated, while others may develop isolated hotspots. BOLUS is a tissue equivalent material which is placed directly onto or into the irregularities, that helps in converting irregular tissue contours into flat surfaces which are perpendicular to the central axis of the ionizing beam, to thereby more accurately aid in the homogenous distribution of the radiation.[12, 13] The most commonly used materials for bolus are tissue conditioners, water, saline, waxes and acrylic resin .[Table/Fig 9]



(Table/Fig 9): Tissue Bolus compensators.

Conclusion

Many oral complications associated with radiotherapy can be controlled with the treatment prostheses provided by the prosthodontist. At times, the head and neck surgeon and radiotherapist are not fully aware of the many primary and supportive services that the maxillofacial prosthodontist can perform through the use of the prostheses. It is recommended that such a specialist be on the team for consultation before planning any head and neck cancer surgery or before starting radiotherapy. These measures make the patient's treatment course smoother and simplify the surgeon's treatment plan.

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