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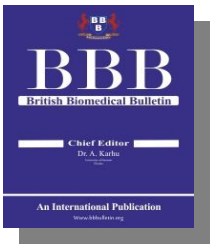

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Prosthetic Carriers for Radiation Therapy of Head and Neck

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ABSTRACT

The term head and neck cancer refers to a group of biologically similar cancers originating from the upper aero digestive tract, including the lip, oral cavity , nasal cavity, Para nasal sinuses, pharynx, and larynx. 90% of head and neck cancers are squamous cell carcinomas, originating from the mucosal lining (epithelium) of these regions. Radiation therapy is the most common form of treatment along with surgery and chemotherapy. Radiotherapy is the art of using ionizing radiation to destroy malignant cells while minimizing damage to normal tissue. Radiotherapy has become astandard treatment option for a wide range of malignancies, but 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. So a novel approach has been made to fabricate customized intraoral stents that can help prevent the unnecessary irradiation of the surrounding normal tissues, thus reducing the severity ofreactions. However, when properly designed and used, these stents are effective in reducing the treatment morbidity.

Introduction

In India, around 40% of the cancers detected are oral cancers. The national Institute of health estimated that as many as 400,000 patients developed oral complications as a result of cancer treatment[1].

Both surgery and radiation therapy are used in treatment of carcinoma. If an adequate margin of normal tissue can be obtained, surgery is the usual treatment, followed by radiation treatment. Radiotherapy is increasingly being used as 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".[2]

A patient who is undergoing radiotherapy for head & neck carcinoma (HNC) suffers from many oral complications that includes- erythema, mucositis, ulcers, fungal infections, xerostomia, caries from decreased salivary flow and pH changes, possibilities of infection in the jaws or thepotential for osteoradionecrosis from infection or trauma to irradiated bone.Hypersensitivity of the teeth,taste loss, oral bacterial shift and periodontal breakdown.[2]

Early dental intervention and counselling is the best way to minimize these oral complications. Ideally, the dental examination and necessary dental treatment should be performed prior to the onset of definitivecancer treatment. During the initial dental appointment, patient should be made to understand about the short and long term effects of radiation to the head and neck. Additionally, the patient should be toldabout increased susceptibility to oral infections and muscular fibrosis which severely limits the ability to open mouth.

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. 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.[1]

The prosthodontistscanactively help in the rehabilitation of cancerpatients by fabricating a whole array of possible prostheses that can be constructedto meet specific patient needs, therebylimiting complications following therapy. In this article various prosthetic carriers are fabricated to prevent the adverse effects of radiotherapy to surrounding tissues are being discussed.

Therefore it is mandatory to understand what radiation prosthesis is. It can be defined as any device artificially fabricated that aids in the efficient administration of radiotherapy to the affected areas and thereby helps in limiting the post therapy morbidity.

To carry these radiations, radiation carriers are used which can be defined as - ancillary prosthesis used to administer radiation to confined areas by means of capsules, beads or needles of radiation emitting materials such as radium or cesium. Its function is to hold the radiation source securely in the same location during the entire period of treatment.

Radiation carriers can also be known as- Carrier Prosthesis,Intracavity Applicator, Intracavity Carrier, Radiation Applicator, Radium Carrier.

These carriers are used to carry the radiation sources-

Close to the site of the treatment known as (Intracavitary) Directly into the tumour (Interstitial).

Carriers are of two types- Preloaded Carriers, After Loaded Carriers. After

loaded carriers are usually advantageous compared to preloaded carriers as the radioactive sources are placed after the carrier is in position, hence minimizing the radiation exposure to personnel handling, positioning and securing such devices.

Indications of Radiotherapy in Head and Neck Lesions

1. Squamous cell carcinomas of soft palate, floor of mouth, tongue, lips and buccal mucosa.
2. Adenocarcinomas of salivary and mucous glands.
3. Primary lymphomas of nasopharynx, tonsils.
4. Carcinomas of maxilla and mandible.
5. Carcinomas of piriform sinus, subglottic area etc.

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).[1]

Interstitial Radiotherapy, also called as Brachytherapy issued to deliver high doses (upto 20000 rads) of radiation over a short distance for a short time period (10-15 hrs).Brachytherapy as a method of radiation therapy in which an encapsulated source or a group of such sources isutilized to deliver gamma or beta radiation at a distance of up to a few centimetres, either by surface, intracavitary or interstitial application.Most commonly used interstitial sources are needles, narrow tubes, wires or seeds containing radioactive cesium, cobalt, gold or iridium.[3]

Materials Used

Heat cure,Tinfoil,Cerrobandalloy,Pb-bi-sn alloys:

Method of Fabrication

For Dentulous Patients

Impressions Made For Maxilla And Mandible With Alginate,When obtaining the mandibular impression, dental modeling compound is used to displace the tongue away from the tray on the side for which the stent is to be fitted, Casts obtained.If the tongue was not displaced properly while making the impression, the mandibular cast must be trimmed so that a 1cm space is created between the tongue and alveolar ridge. 3 or 4 strips of baseplate wax are softened and placed between the teeth, and a bite recorded to form occlusal index.Casts with occlusal index mounted on suitable articulator, with incisal pin opened to 2-3 mms.A wax rim of 1-2 cms thick is prepared to fit into the lingual space created by reduction of cast or obtained in the impression.

Softened wax is placed inside the cast and articulator closed so that a ring outline form can be moulded.Wax pattern is invested and processed into methyl methacrylate to obtain a stent that is finished,polished and further refined if necessary.Cerro bendalloy is melted at 140^0 F and poured into cavity prepared in the prosthesis.When pouring the stent around a corner it is advisable to utilize clay to block out curved section and pour one straight section at a time. A layer of wax or auto polymerizing methyl methacrylate should be added to the exposed surface of alloy to prevent back scatter.

For Edentulous Patients

The stent can be made by duplicating the patient's existing dentures or by making maxillary and mandibular impressions and mounting on the cast.

The shield is then attached on the lingual side of the maxilla and mandible as previously described.

Following Are the Radiation Devices Used in Brachytherapy

1. Perioral Cone Positioning Stent (Fig.1)

This type of stent is commonly used whenboosting the dose to the trauma site. It holdsthe cone in the repeatable and the exactposition as desired by the radiotherapist,thus minimizing the chances of themovement of the cone during a particulartreatment session. It is used in the treatmentof superficial lesions involving the anteriorfloor of the mouth and the hard and softpalate. The actual cone or cylinder of thesame diameter as the cones is used to forman acrylic resin ring of 5 to 6 cms long. Tinfoil is wrapped around the cone as aseparator 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 intothe positioning stent for verification of the position.

2. Shielding Stent For Carcinoma of Buccal Mucosa (Fig.2)

They are used to shield the vital structureswhich are adjacent to radiation therapy sitesfrom excess dosage of radiation.When electron beam therapy is used totreat lesions of the buccal mucosa, skin orthe alveolar ridge, mucositis is frequentlyobserved in areas which are adjacent to themetallic dental restoration.

The therapybeam scatters electrons from the high-Zmetals used in the dental alloys, resulting ina local dose enhancement, which leads toexcess dose in the surrounding tissues, thus causing mucositis. Effective shields can befabricated to protect the tongue, salivaryglands and the opposite side of the mandible.

Low melting alloys like Cerroband, Pb-Bi-Sn, and Lipowitz are used as shielding materials. Cerrobend alloy ispreferred because of its low meltingtemperature and it effectively prevents thetransmission 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, tocreate space between the tongue and thealveolar ridge. Casts are mounted in centric relation.

A lingual extension of wax ismade in the space created, which ishollowed out to create a cavity which is 1cm 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.

3. Tongue Depressing Stent (Fig.3)

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 isprepared for the dentate patient, that extendslingually from both the alveolar ridges, witha flat plate of acrylic resin which serves todepress the tongue.

A hole is made in theanterior segment in which the tip of thetongue is placed in order to establish areproducible position.

4. Position Maintaining Stent (Fig.4)

It is used to precisely position structureswhich are to be treated in fixed andrepeatable positions for multiple treatment sessions.

They are used to position movablestructures like tongue, soft palate etc.

Used to precisely positionstructures to be treated in a fixed and repeatable positions for multiple treatment sessions.

5. Stent with cerroband alloy in place. (fig.5)

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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.

6. Radition Carrier Incorporated with Irridium Needle.(fig.6)

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).

7. Shielding Stent for Carcinoma of Palate (Fig.7)

For treatment of carcinoma of hard palate.

8. Lingual Positioning and Shielding Stent for Carcinoma of Mandibular Alveolous. (fig.8)

Cancer is seen on the alveolus region also therefore high dose delivery leads to erythema, mucositis, ulcers, fungal infections, xerostomia, caries fromdecreased salivary flow and pH changes, possibilities of infection in the jaws or thepotential for osteoradionecrosisfrominfection or trauma to irradiated bone ,Hypersensitivity of the teeth, taste loss.

In order to prevent scattering of rays in adjacent tissues,shielding stent for carcinoma of mandibular alveolous is fabricated.

9. Tissue Recontouring Stent in Place.(fig.9)

These stents are useful when the beam is adjusted for midlines for treating skin lesions which are associated with lips.

Due to the curvature of lip low doses of radiations are delivered at corner of mouth.

These stents arefabricated by modelling wax and areprocessed in acrylic resin.

This stent flattens the lip and the corner of the mouth, thereby placing the entire lip in the same plane and therefore reducing the dose of radiations.

Conclusion

Many oral complications associated with radiotherapy can be controlled with the treatment prostheses provided by the prosthodontists. At times, the head and neck surgeon and radiotherapist are not fully aware of the many primary and supportive services that the maxillofacial prosthodontists 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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Figure 1. Perioral cone positioning stent

Figure 2. Shielding stunt for carcinoma of buccal mucosa

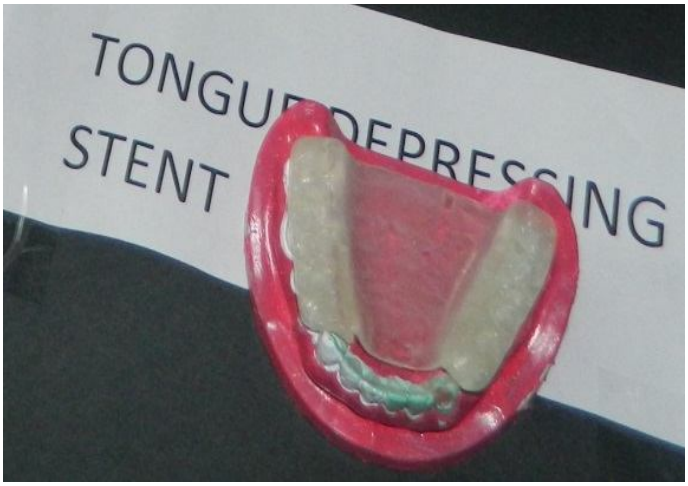

Figure 3. Tongue depressing stunt

Figure 4. Position maintaining stent

Figure 5. Stent with cerrobend alloy in place

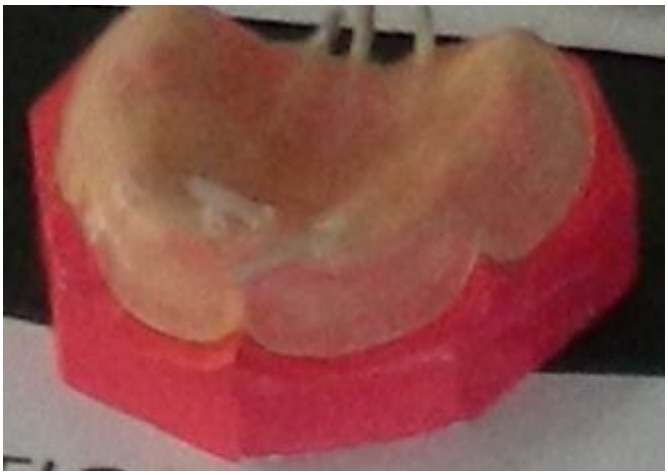

Figure 6. Radiation Carrier Incorporated Withirridium needle

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Figure 7. Shielding stent for carcinoma of palate

Figure 8. Lingual positioning and shielding stent for carcinoma of mandibular alveolus mucosa

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Figure 9. Tissue recountouring stent