

A customized orofacial brachytherapy carrier: A clinical report

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This report describes a method in which a customized carrier was fabricated for a patient experiencing difficulty during initial brachytherapy treatment, while using a conventional radiation carrier. When designing a customized brachytherapy carrier for a maxillary defect, it is imperative to achieve stability and retention to ensure maximal therapeutic radiation to the desired location. The fabrication and benefits of using a customized, retentive, stable, and comfortable orofacial brachytherapy carrier are described. (J Prosthet Dent 2005;93:24-7.)

Squamous cell carcinoma (SCC) of the gingiva and the alveolar mucosa comprise about 10% of all oral malignancies.¹ Patients with oral malignancies are often treated with surgery followed by radiation therapy. Radiation therapy is the therapeutic use of ionizing radiation and can be applied via external beam or brachytherapy.^{2,3} Brachytherapy is a method of radiation treatment in which sealed radioactive sources are used to deliver the dose a short distance by direct insertion into the tissue (interstitial), placement within a cavity (intracavitary), or surface application (molds).¹ High-dose-rate after-loading brachytherapy refers to a method of delivering a high-activity radioactive source (needles, narrow tubes, wires, or small seeds) through a cable that is remote controlled by a computer.¹ Mold brachytherapy is radiation delivered via a carrier device known as a mold. It is usually delivered by custom-fabricated carriers, designed to provide a more constant and reproducible geometry for source positioning.³ Radiation carriers are customized to fit the patient in a comfortable, stable, and retentive manner.

There are many advantages for delivering therapeutic radiation using brachytherapy. The primary advantage is that a high radiation dose can be given to the tumor while sparing the surrounding normal tissues.¹ It is important that the hollow tubes (catheters) within the mold remain in the exact position determined by the radiation oncologist. It is the responsibility of the prosthodontist fabricating the carrier to maintain the predetermined position of the catheters. The purpose of this report is to describe a method of constructing a retentive and stable carrier device to ensure delivery of



Fig. 1. Patient presentation.

therapeutic radiation to a specific site, while maintaining patient comfort.

CLINICAL REPORT

A 77-year-old black man presented to the Montefiore Medical Center with a history of chronic sinusitis unresponsive to pharmacologic management. A computed tomography image of the right maxillary sinus revealed a right sinus mass. A biopsy was performed, and findings

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Fig. 2. Lateral view of defect.

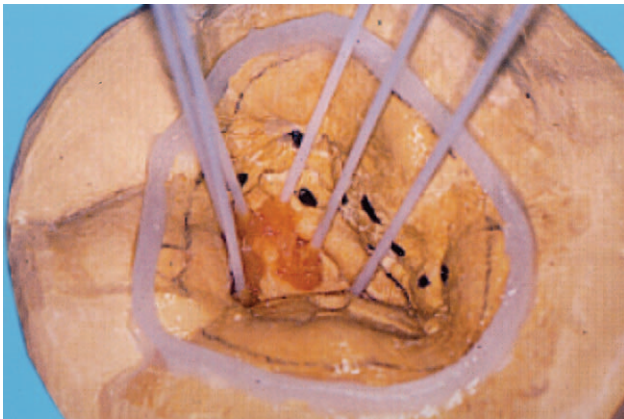


Fig. 4. Catheter location designations.

of the histopathologic examination of the specimen were consistent with a well-differentiated squamous cell carcinoma. The patient was staged as T3N1MO¹ and presented with options that included surgery and postoperative external beam radiotherapy.

The patient (Fig.1) underwent a modified right neck dissection, right orbital exenteration, and a right total maxillectomy. After approximately 4 weeks of external beam therapy, the patient developed symptoms of grade IV mucositis, dehydration, and malnutrition. The decision was made to discontinue external beam radiotherapy. The total dose of external beam radiation was 32 Gray. The patient was referred to the department of postgraduate prosthodontics at Montefiore Medical Center, Bronx, NY, for fabrication of a customized radiation carrier to be used in remotely controlled after-loading brachytherapy.

Upon clinical examination of the patient, it was observed that the patient's defect was rather large and irregular in size (Figs.1 and 2). Due to the nature of the defect, it was necessary to take measures to ensure retention, comfort, and stability when fabricating the

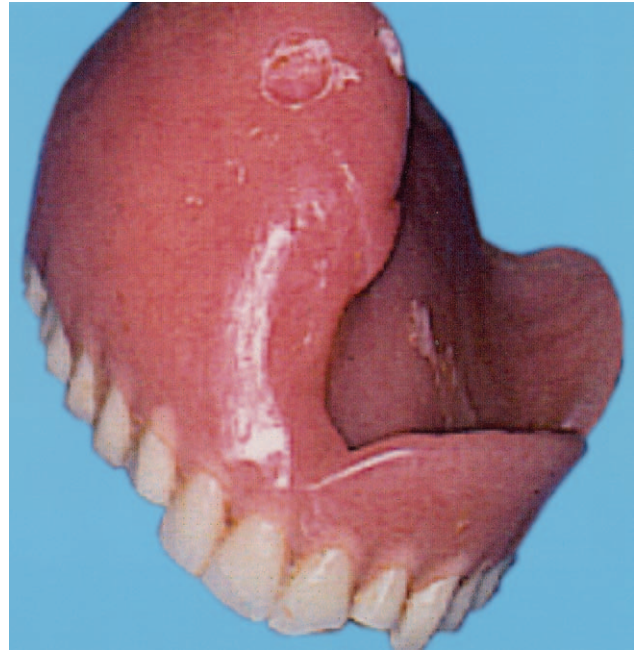


Fig. 3. Reversible key way.

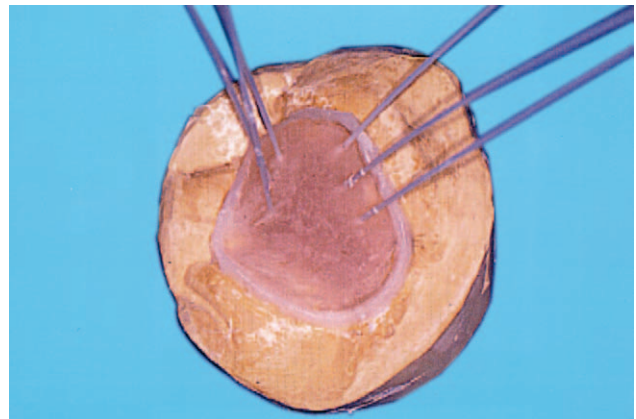


Fig. 5. Definitive cast.

prescribed carrier. First, a reversible key way was placed into the superior surface of the patient's existing obturator prosthesis to assist in the orientation and stabilization of the brachytherapy carrier (Fig. 3). This procedure was accomplished using a large round acrylic bur (Henry Schein, Melville, NY). The obturator prosthesis was inserted into the defect, and the patient was asked to close in habitual occlusion. A petroleum jelly-lubricated (Petroleum Jelly White; Cumberland-Swan Inc, Detroit, Mich) gauze was wrapped in dental floss (Reach; Johnson and Johnson, New Brunswick, NJ) and placed into the posterior superior and inferior aspect of the defect. An irreversible hydrocolloid (Jeltrate; Dentsply/Caulk, Milford, Del) impression of the right orbit and

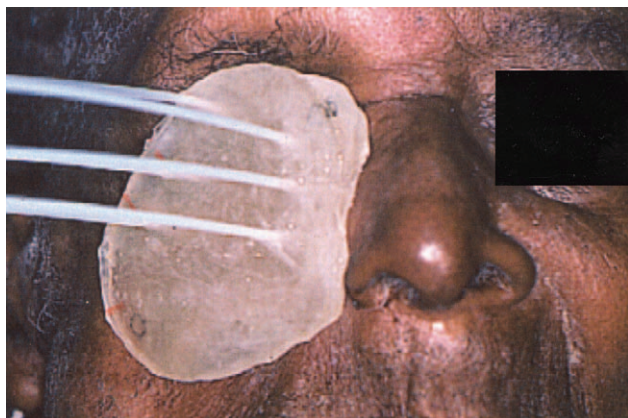


Fig. 6. Intraoral assessment.



Fig. 7. Orthodontic head gear.

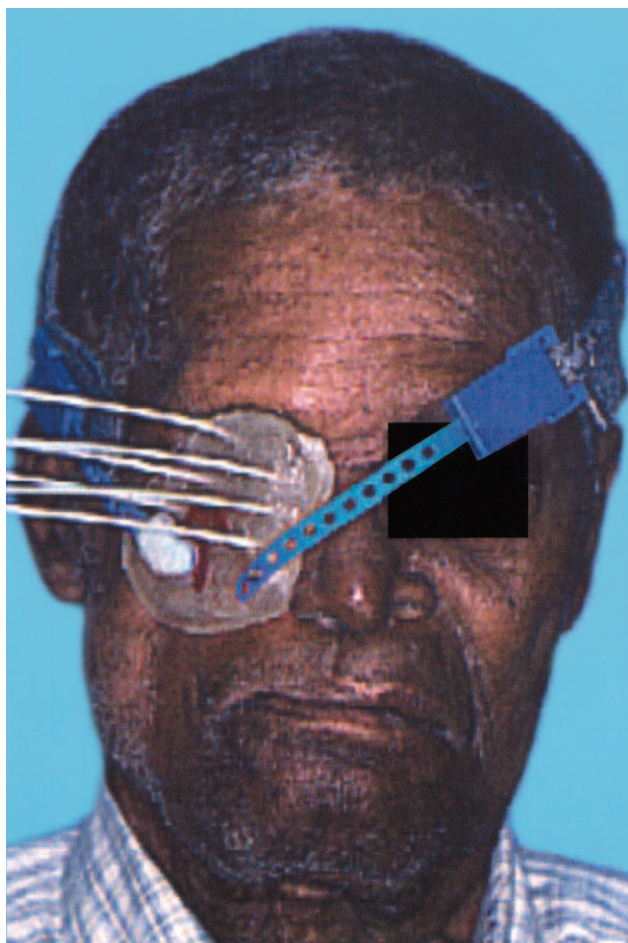


Fig. 8. Definitive carrier inserted.

maxilla was made, incorporating internal and external anatomy. The key way details were obtained by syringing the impression material onto the superior aspect of the obturator prior to placement intraorally. The definitive impression was boxed with boxing wax (Boxing Wax; Miltex, Inc, York, Pa) and poured in Type III dental

stone (Denstone, Modern Materials; Heraeus Kulzer, Armonk, NY).

The definitive cast was recovered, and the peripheral border of the planned carrier was outlined in border wax (Utility Wax Round Strips; Henry Schein). Undercuts within the cast were blocked out with inlay wax (Blue Inlay Casting Wax; Kerr, Romulus, Mich). The location of the after-loading catheters was determined by the radiation oncologist and radiation physicist in accordance with dosimetry for the target volumes. The catheters were secured in place with sticky wax (Sticky Wax Strips; Kerr), and autopolymerizing polymethylmethacrylate resin (Acraweld Repair Resin; Henry Schein) was mixed and poured into the definitive cast (Figs. 4 and 5). The carrier was recovered from the cast, and patient comfort, carrier stability, and retention were assessed intraorally (Fig. 6).

It was observed that despite key placement into the obturator prosthesis and extension of the impression material onto the patient's external anatomy, further retentive elements were necessary to achieve adequate comfort, stability, and retention of the carrier. An orthodontic occipital-high pull headgear (3M/Unitek, Monrovia, Calif) was attached to the carrier with autopolymerizing acrylic resin at one end and a Pindex pin (Pindex; Coltene/Whaledent Inc, Mahwah, NJ) (Fig. 7) at the other. The pin was adapted to the external surface of the carrier to allow the radiation oncologist to adjust the strap as needed for brachytherapy treatment (Fig. 7). A customized orofacial brachytherapy carrier was fabricated whereby all objectives and goals were achieved (Fig. 8). The patient underwent brachytherapy treatment for the scheduled dosimetry fulfilling the prescribed dose of 65 Gray.

DISCUSSION

Anatomic sites that are difficult to treat in terms of delivering a uniform dose of radiation include maxillec-

tomy cavities and the pharynx intraorally, and the nose, ear, and orbit extraorally. This is due to a lack of tissue or a large tissue space, difficult access to the tissue, or surface nonuniformity. It is because of the location of the defect in this situation that measures were taken to ensure retentiveness, stability, and comfort of the customized carrier.

Close proximity of vital structures within the head and neck make it difficult to treat the primary or metastatic lesion without damaging the surrounding structures. Therefore, it was imperative that the catheters were positioned in the exact location determined by the physician and radiation oncologist. In the past, gauze compresses were used to secure the catheters into position; however, this method may not be reliable when stabilizing a large irregularly shaped carrier. To avoid movement of the carrier during brachytherapy, the irreversible key way placed into the intracavity portion of the intraoral obturator prosthesis allowed for the carrier to "lock" into position upon insertion by the patient. The key way also acted as a guide for proper insertion. Prior to stabilization by the external orthodontic high pull head gear, the carrier moved, and the catheters were repositioned in a different direction than originally specified by the radiation oncologist. This would have defeated the purpose of incorporating the catheters. Comfort of the radiation carrier is directly related to the stabilization of the customized carrier. If the patient is uncomfortable, the likelihood of radiation treatment completion may be greatly reduced.

SUMMARY

This clinical report described a method of constructing a customized orofacial brachytherapy carrier device that allowed the radiation oncologist, prosthodontist, and orthodontist to enhance the stability, retention, and comfort of an orofacial-brachytherapy carrier. This method ensured minimal radiation to unaffected surrounding tissues and anatomic structures, while maximizing radiation directly to the specific sites.

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