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Custom Made Mold Brachytherapy

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1. Introduction

Radiotherapy (RT) can be effective for primary BCC, recurrent BCC or as adjuvant for incompletely excised BCC in patients where further surgery is neither possible nor appropriate. Radiotherapy is a mixture of superficial, electron beam, and brachytherapy for curved surfaces. Treatment in fractions over several visits may produce better cosmetic outcomes than a single fraction treatment.[1] Radiotherapy is contraindicated in radiotherapy recurrent BCC, genetic syndromes predisposing to skin cancer and connective tissue disease. Significant side effects are radionecrosis, atrophy, and telangiectasia. Skin cancers can arise from radiotherapy field scars and should be avoided in younger age groups.

Brachytherapy has been widely used for the treatment of head and neck cancers. Mold therapy is excellent for the treatment of superficial carcinomas because it allows the planning of an adequate dose distribution before treatment and provides highly reproducible irradiation.[2,3] However, therapists and members of the nursing staff can be exposed to radiation if remote afterloading units are not used. Although the combination of mold and remote afterloading units has been used in the head and neck region, including the oral cavity,[4-6] its use as a method of radical radiotherapy has been extremely limited because of the low flexibility of the connection catheters. Recently developed units with 192-Ir microsources have more flexible catheters and molds that are better suited to uneven regions such as the oral cavity. The first case of superficial carcinoma of the nasal vestibule that was successfully treated by a technique combining a mold and a remote afterloading unit with a 192-Ir microsource was reported in 1992.[7] However, no well-controlled case of treatment of an oral carcinoma through use of this combined technique has yet been reported, although trials of interstitial use are now in progress.[8-11] Details on construction of molds used in this type of therapy have been described in the literature.[12] Because of the favorable reports concerning the combined technique, we planned to use it for primary oral carcinomas as a part of radical radiotherapy.

Basal cell carcinoma (BCC) is an epithelial tumor of the skin.[13] It arises from the basal cells of the surface epidermis and can exhibit various clinical manifestations. It predominantly occurs on exposed areas of the skin. Actinic radiation is considered a major etiologic factor. It appears to be directly proportional to the amount of exposure of the skin to sunlight and is inversely proportional to the degree of skin pigmentation. Chronic arsenic exposure and genetic factors may also play a role in the development of BCCs. BCCs are highly variable and several different clinical types are recognized.[13,14]

Various methods have been used for treatment of BCC. These techniques have included electrocoagulation followed by curettage, electrosurgery, chemosurgery, chemotherapy, and radiation therapy.[13,14] Radiation therapy can be delivered either by external beam radiation or by brachytherapy. Brachytherapy is usually applied in the form of interstitial therapy, which involves the implantation of radioactive sources into the tissues or the application of radioactive molds to the skin surface.[15] Mold brachytherapy is usually delivered in specially constructed carriers. Surface radiation carriers primarily indicated for the treatment of superficial lesions. They are helpful where external radiation can be used as a boost dose.[13] Such carriers can vary in design from the simple to complex, according to treatment needs.[14] The radiation carrier should be easy to fabricate and be readily usable by the radiation oncologist. Carriers that will be worn for extended periods must be carefully constructed to provide maximal patient comfort and to ensure at the same time correct dose delivery to the treatment area and reproducibility of the treatment at repeated sessions. An irreversible hydrocolloid is used for making impression. The carrier can be constructed from autopolymerizing acrylic resin rather than heat-curing acrylic resin. Cerrobend alloy is chosen for shielding purposes.[16]

2. Mold production procedure

It consisted of a mold of polymethyl methacrylate (PMMA) of 5 mm thickness, built over a plaster mold obtained as an individual impression of the region of the face to be treated. The construction of this PMMA mold was very similar to the construction of dental prostheses. First, an impression of the region of the patient to be treated was obtained with condensation silicones of putty texture (Optosil, Bayer), carefully adapted to the surface of the skin with gentle pressure. Over this impression a plaster model was obtained, with the same surface characteristics as the patient's face. Over this plaster model, the contours of the tumor were carefully drawn, requiring generally the presence of the patient. Over this plaster model, successive thin layers of acrylic material with catalyzer were deposited, until a minimum thickness of 5 mm was obtained, taking care to avoid sharp surfaces. This first layer of PMMA had to act as a bolus material and as a first support for the brachytherapy catheters. On it, the appropriate number of plastic tubes, covering the area to be treated, were fixed with an instant contact glue. Usually 3 to 7 parallel and equidistant tubes were placed, following the contour of the zone to treat, parallel to the skin's surface and avoiding sharp turns. The distance between the catheters ranged between 5 to 10 mm. The next step was to check that the radioactive source ran without interruption along the entire length of the catheters, by connecting the tubes to the microselectron and running the check cable. In case of curvatures of a diameter smaller than that required to pass the microselectron source through the tube, the plastic tube was replaced and glued in a new position, checking again the pass of the source through the catheters. Only when the source passed through all channels without any problem, was the custom mold completed by adding the necessary quantity of PMMA acrylic material and catalyzer to cover all the catheters and to give solidity to the mold. To harden the assembly, it was heated to 70°C for 5 minutes with a hair dryer, taking care to avoid deformations of the guide tubes. In the sides of the applicator were built some, usually two, buttonholes in which an elastic tape was fixed to maintain the mold in the correct position during the entire treatment time and facilitating the reposition of the assembly for daily treatment. Treatment parameters were calculated by the 3D treatment planning software (Plato, Nucletron Int. BV). Each source dwell position was

weighted individually to ensure the best isodose distribution. Geometrical optimization in volume and distance was done. Isodoses at skin surface and at 5-mm depth were plotted and the dose to 5 easily identifiable dose points calculated. The treatment parameters were chosen, with the best fit of isodoses to the target volume. Before treatment, a test run without the patient was done: the mold was attached to the plaster model with 5 thermoluminescent dosimeters (TLD) placed in the dose points and guide tubes connected to the microselectron. The results of the TLD were read and compared with the calculated values. A verification autoradiograph of the applicator was obtained modifying the prescribed dose to 50 cGy to the film but maintaining the same weight to each dwell time. In the cases of tumors close to the eye, a lead sheet 5 mm thick was placed in the corresponding zone of the mold in order to reduce the dose to the eye. The procedure of construction, dosimetry, and verification of the custom-made mold required 3 working days, requiring 2 visits of the patient before beginning the treatment, one to take the impression of the face and the second to draw the tumor and treatment volume on the plaster model. The custom-made applicators were used to treat tumors of more than 2 cm diameter, or those of smaller size but seated in a non-flat region or a difficult-to-fix area with the Brock's applicators. In one patient it was necessary to built a second mold at the halfway point of the treatment, due to changes in the surface of the skin resulting from tumor regression.

2.1 Tolerance of custom-made molds

All patients tolerated treatment without difficulties. Patients helped the nurses to fit the custom-made mold in place. Treatment time took 3 to 8 minutes in each session. The custom-made molds were very ease to use, and the patients felt comfortable during treatment. There were no cases of interruption of treatment resulting from break of the applicator or constriction of the plastic tubes preventing the radioactive source from traveling properly to the treatment dwell positions.

2.2 Conclusions

Radiotherapy is a highly effective treatment of skin carcinomas of the face and head. The use of HDR brachytherapy with custom-made external molds permits one to obtain a uniform dose distribution with a sharp gradient in the edges of the applicator. The custom-made molds are easily used and permit a highly accurate daily treatment reproduction. They enable one to obtain excellent local control with minimum treatment-related sequelae or late complications. Given the excellent results, HDR brachytherapy with external custom-made molds is a reasonable alternative to other radiation therapy techniques for the treatment of skin carcinomas of the head and face.

3. Clinical reports

3.1 Case report 1: A hinged flange radiation carrier for the scalp

The purpose of this cases was to describe fabrication of a hinged flange radiation carrier for a patient with BCC of the scalp.

A 63-year-old man with the chief complaint of scalp lesions of 15 years duration was examined at the Hacettepe University hospital. These lesions were biopsied and diagnosed

as BCC (Fig. 1). Radiation treatment of 4 days duration (details could not be obtained) to the scalp performed 45 years ago was noted in the patient's history. Total scalp excision was suggested as the treatment of choice. However, the patient refused the surgical intervention because of cosmetic problems and was accordingly referred to the department of radiation oncology. The treatment that was selected was a specially constructed mold suitable for remotely controlled after-loading brachytherapy. The patient was referred to the department of prosthodontics for fabrication of the radiation carrier

3.1.1 Procedure

The catheter radiation carrier was fabricated to ensure the fixation of the after-loading catheters in the required orientation to make the treatment reproducible. For fractionated treatment, it was decided to fabricate a catheter carrier mold. The patient's head was shaved, and the border of the shaved area was outlined on the skin with indelible pencil. The patient's head was lubricated with petroleum jelly (Aafes). The moulage impression of his head was made with irreversible hydrocolloid impression material (Blueprint Cremix, Dentsply, DeTrey, England) supported with gypsum (Kristal Alçi Sanayi Ltd., Ankara, Turkey). The surface was outlined with a pencil and boxed with wax. The impression was then poured in dental stone. One layer of baseplate wax (1 mm in thickness) was adapted over the cast. The catheters were placed parallel to each other at spaces of 10 mm (Fig. 2). The spacing was determined by the radiation oncologist and the radiation physicist in accordance with dosimetry for the target volumes to avoid creating cold or hot spot areas in the treatment region. Autopolymerizing methyl methacrylate (Meliodent, Bayer Dental, Bayer UK Limited Bayer House, Newbury, U.K.) was prepared, poured, and spread over the surface. The device was designed to be two pieces from frontal to cervical border. An acrylic resin hinge was fabricated and embedded into the two pieces (Fig. 3, *A* and *B*). This approach was necessary because undercuts over the head prevented placement of the carrier as a single unit. After polymerization and trimming, the device was tried on the patient's head and adjusted (Fig. 4). Remote control after-loading technique was used to provide radiation and to distribute the active sources in the mold. High dose rate (HDR) microselection equipment with Ir-192 source and 1.77×10^{11} Bq activity was used. A total dose of 4050 cGy at 0.5 cm skin depth was given over a period of 3 weeks.

3.1.2 Discussion

Radiation prostheses have assisted the delivery of radiotherapy for carcinomas. These prostheses are used to protect or displace vital structures from the radiation field, locate diseased tissues in a repeatable position during radiation treatment, position the radiation beam, carry radioactive material or dosimetric devices to the tumor site, recontour tissues to simplify the therapy, or shield tissues from radiation. Radiotherapy has been used in the management of the head and neck region for many years. It has been shown to be effective in the treatment of superficial lesions. [15,16] Superficial lesions usually have a higher cure rate with radiation than do deeply infiltrating lesions. Radiation treatment of BCC is reported to be 96.4% with radiation therapy.[17] Small BCCs that occur in essential cosmetic area can be successfully treated with a short treatment course[14] (Fig. 5). Surgery is indicated, especially when the lesions have arisen in damaged skin or have invaded cartilage.[18] Modern brachytherapy is delivered by remote controlled after-loading systems where the

radioactive sources are delivered to the prepositioned treatment catheters HDR remote control after-loading brachytherapy is used in the treatment of patients with curative intent.[19] There are several advantages in using HDR remotely controlled after-loading systems. Radiation exposure of treating and nursing staff is virtually eliminated. Patient immobilization time is short; therefore complications that result from prolonged bed rest, such as pulmonary emboli and patient discomfort, is decreased. Treatment planning and dosimetry are more exact. Radioactive sources can be accurately positioned to a specific region. The sources have been arranged for loading according to the results of calculations by the radiation physicist to determine dose distribution. This ensures delivery of the calculated degree of radiation. If a change in dosage is required, it can be adjusted accordingly. Treatment can be performed on an outpatient basis, reducing healthcare cost. The use of external carrier fixation devices allows more constant and reproducible geometry for source positioning. Surface radiation carriers are being used more frequently with high dose remote after-loading devices.[19]

3.1.3 Conclusions

A hinged flange cranial radiation carrier was fabricated for a patient with basal cell carcinoma of the scalp. This method allowed for accurate and repeatable positioning of the carrier to facilitate radiation therapy. The use of the after-loading principles of brachytherapy allowed for the delivery of an accurate dose of radiation while minimizing radiation exposure to the radiation oncologist and nursing staff. The patient is in complete remission 15 months after treatment.
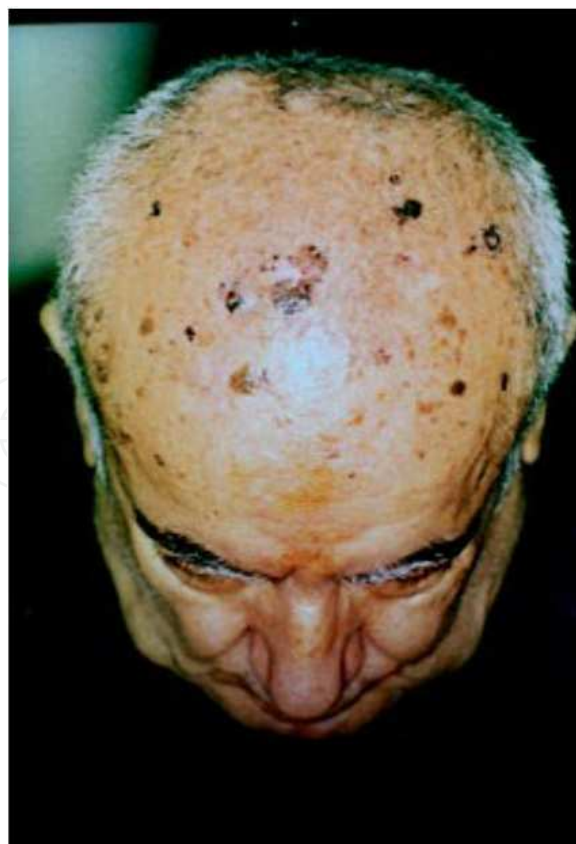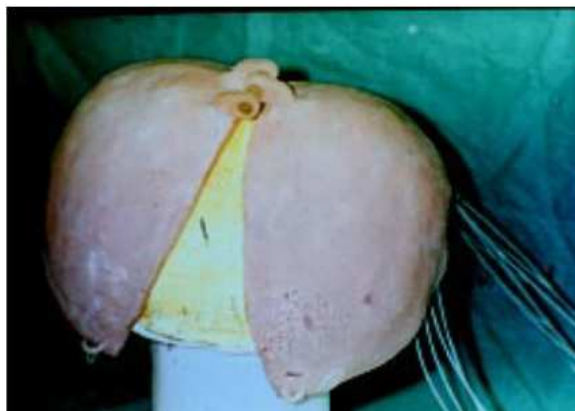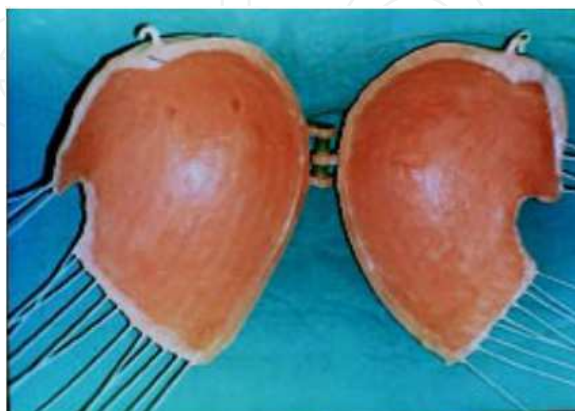

Fig. 1. View of patient with lesions on scalp.

Fig. 2. Catheters were embedded within wax plates and placed parallel to each other at intervals 10 mm on cast.

A

B

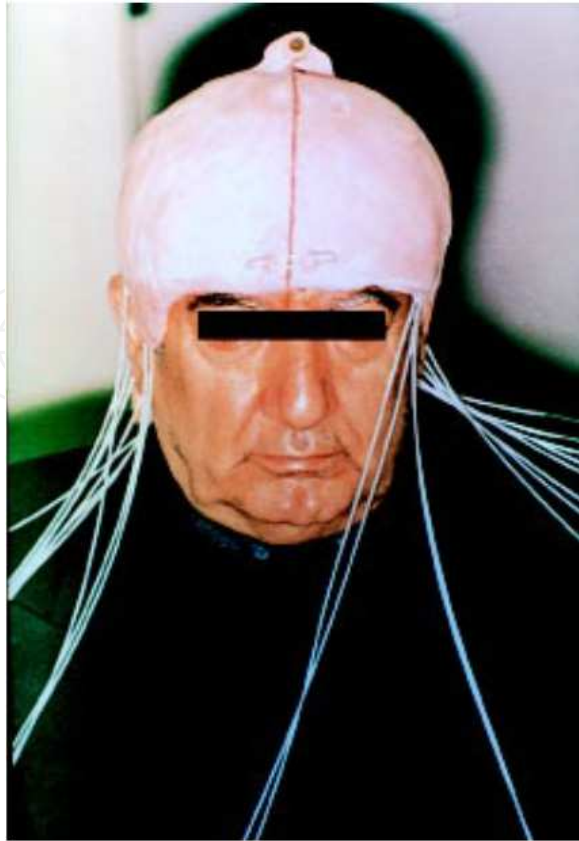Fig. 3. **A,** Outer view of carrier on cast. **B,** Inner view of carrier.

Fig. 4. Radiation carrier is placed and fixed on patient's head.

Fig. 5. View of patient's scalp 15 months after radiation treatment.

3.2 Case report 2: Periauricular mold brachytherapy

A 42-year-old male was referred to the Otorhinolaryngology Department of Hacettepe University with the clinical diagnosis of recurrent BCCA of the right pinna (Fig. 6). The patient was treated in 1992 for a lesion in the periauricular area that was totally excised and pathologically diagnosed as BCCA. In 1995, a recurrent BCCA lesion infiltrating into the parotid gland was excised; and in October 1995, a retroauricular recurrent BCCA was excised and the patient treated with electron beam radiotherapy at the dose of 5000 Gy using fraction size of 250 Gy in 1996. In October 1996, a recurrent BCCA in the fronto-parietal area was excised; and in 2000, a recurrent BCCA in the remaining right auricle infiltrating to the mastoid process was excised. A recurrent tumor was then diagnosed in the mastoid cavity in September 2001 and a final attempt at excision of the tumor was made with known microscopic residual disease. It was then decided to treat the patient with brachytherapy. The patient was informed about possible severe side effects of the treatment, and the patient was referred to the Department of Prosthodontics for fabrication of a radiation carrier. The patient was reclined in dental chair; the head positioned allowing the patient to rest in a relaxed position with easy application of impression material to the lesion area. The neighboring area with hair was isolated with petroleum jelly, and the orifice of the outer auricular canal was filled with moist gauze. The external border of the area that was intended to be included in impression was outlined with utility wax (Moldwax; Sankay Ltd., Izmir, Turkey). An irreversible hydrocolloid impression material (Kromopan; Lascod Sp.H., Firenze, Italy) was mixed and poured over the target area and slightly pushed and directed to the desired areas with a brush. Then, a simple wrought wire metal mesh was applied over the impression material for eliminating possible distortions that may occur during the removal of the impression and subsequent setting of the cast. The impression was poured with a Type III dental stone (Amberok, Ankara, Turkey). A 0.5-mm thick layer of pink modeling wax plate (Multiwax; B.D.P Industry, Ankara, Turkey) was heated slightly and adapted onto the model to act as a spacer preventing the direct contact of catheters to the tissues, extending through the borders of the target area (Fig. 7). To avoid developing hot or cold spots, the spaces between the plastic carrier tubes (Nucletron; Veenendaal, Netherlands) and the space between tubes and tissues were standardized by the use of wax sheets of uniform thickness. The catheters were placed parallel to each other with 8 mm distance. As the surface of the target tissue was not perfectly smooth, the adaptation of catheters to the superficial contours of these areas was impossible; two catheters were superimposed in these areas where needed (Fig. 8). The mold was prepared with clear autopolymerizing acrylic resin (Akribel; Atlas- Enta, Izmir, Turkey) overextending 2 mm from the treatment area. The wax spacer was removed, and this area was filled with a soft-lining material (Visco-Gel; Dentsply De Trey, Konstanz, Germany) to provide an excellent adaptation of the radiation mold to the target area (Figs. 9 and 10). A remote-controlled high-dose-rate (HDR) after-loading unit (microselectron; Nucletron) was used for the treatment. Q4The CTV defined as 5-mm tissue starting from the surface Q5 of the mold and therefore encompassing microscopically residual tumor volume. Dose calculations were performed using Plato brachytherapy treatment planning system (Nucletron). The dose was specified at the reference dose-rate curve encompassing the CTV. A total radiation dose prescribed to the reference isodose was 2500 cGy in 10 fractions in an overall treatment time of 5 days. The patient did well during and after the treatment. The patient was lost to followup, after followed in complete remission for 2 years.

3.2.1 Discussion

Radiotherapy has been used in the adjunctive management of the head and neck region for many years. It has been shown to be effective in the treatment of superficial lesions [20,21]. Superficial lesions usually have a higher cure rate with radiation than do deeply infiltrating lesions [20]. Successful radiation treatment of BCCA is reported to be 96.4% with radiation therapy [28]. Small BCCAs that ocur in critical cosmetic areas may be successfully treated with a short treatment course [21]. Radiation delivery devices are important for delivery of radiotherapy and are used to protect or displace vital structures from the radiation field, locate diseased tissues in a repeatable position during succeeding radiation treatment sequences, position the radiation beam, carry radioactive material or dosimetric devices to the tumor site, recontour tissues to simplify the therapy, or shield tissues from radiation [20,21]. However, the technique of implanting radioactive materials into target tissues may have potential disadvantages. The major concern is the potential for nonuniformity of the dose delivered throughout the implanted volume. This can occur if the radioactive sources are spaced too closely together (thereby producing a hot spot) or too far apart (leading to a cold spot). Therefore, brachytherapy (and particularly interstitial implantation therapy) requires the radiotherapist to have adequate technical and conceptual skills to achieve good radiation dose distribution [29]. Some clinicians have stated that most patients who have had radiation treatment for malignancies will, in time, develop new cancers in the irradiated area. Experienced radiotherapists who carefully followed their patients for many years find this to be an extremely rare possibility and irradiation should never be withheld from the patient for this reason. The best local control results for patients with previously irradiated recurrent head and neck cancers were reported to be with brachytherapy [30]. The reason for better local control was argued in the literature and reported that tumors with good prognostic factors (smaller tumors and oral cavity locations) were suitable for treatment with brachytherapy. Moreover, higher radiation dose could be delivered by brachytherapy [30]. Our patient was previously received high-dose external beam radiation, tumor and we decided to deliver reirradiation with brachytherapy. Q7 We delivered 25 Gy in 5 days, divided in 10 fractions. Most authors used similar fractionation; however, most used higher doses. Narayana et al. [31] also delivered HDR brachytherapy, a total dose of 34 Gy in 10 fraction, twice daily, and reported 2-year local control rate of 71% for recurrent squamous cell carcinoma of the head and neck. Martinez-Monge et al. [32] also delivered HDR brachytherapy for previously irradiated recurrent head and neck carcinomas, the authors used 40 Gy in 10 fractions and achieved 4-year local control rate of 85.6%. We have only one case and unfortunately we could not report long-term followup. Because of basal carcinoma histopathology and prior external beam radiotherapy, we think that 25 Gy would be enough to achieve local control. There are many advantages of using HDR remotely controlled after-loading radiation delivery systems that cannot be overlooked. This method takes advantage of the rapid decrease in dose with distance from a radiation source (inverse square law). The intensity of radiation is inversely proportional to the square of the distance from the source. Thus, a high radiation dose can be given to the tumor while sparing the surrounding normal tissues. Patient immobilization time is short; therefore, complications that result from prolonged bed rest, such as pulmonary emboli and patient discomfort, are decreased. Treatment planning and dosimetry are more exact. Radioactive sources can be accurately positioned to a specific region. The sources have been arranged for loading according to the results of calculations by the radiation physicist to determine dose distribution. This ensures

accurate delivery of the calculated magnitude of radiation. If a change in dosage is required, it can be adjusted accordingly. The use of external carrier fixation devices allows more constant and reproducible geometry for source positioning. Surface radiation carriers are being used more frequently with highdose remote after-loading devices [23].

3.2.2 Conclusion

This method allowed accurate and repeatable positioning of the radiation carrier to facilitate therapy. Carriers that will be worn for extended periods must be carefully constructed to provide maximal patient comfort and to ensure, at the same time, correct dose delivery to the treatment area and reproducibility of the treatment at repeated sessions. Mold brachytherapy is an option for reirradiation of recurrent head and neck tumors in selected group of patients.

Fig. 6. Patient with recurrent basal cell carcinomas of right periauricular area.
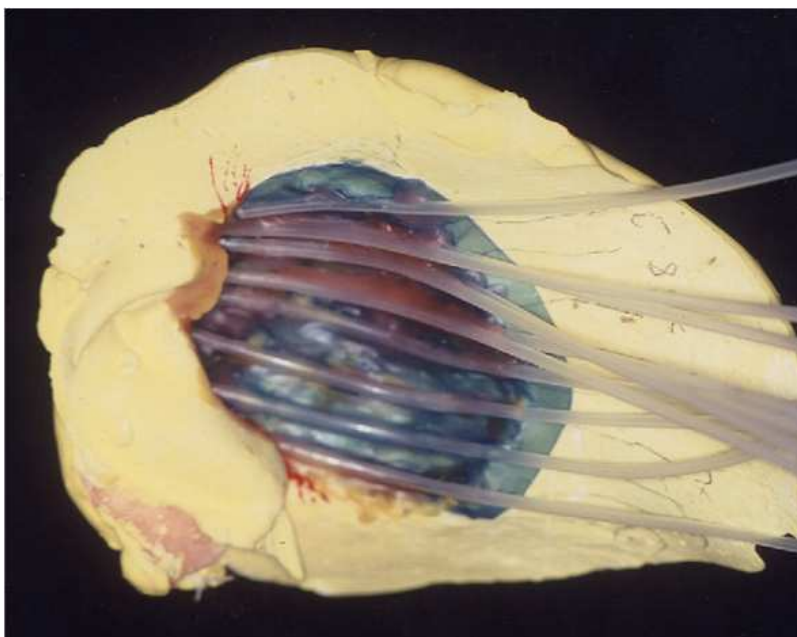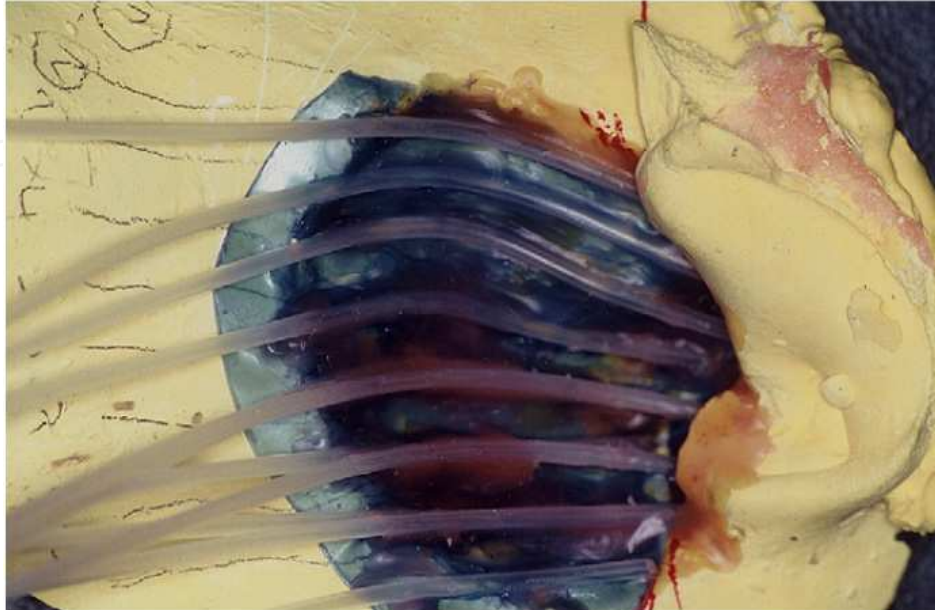

Fig. 7. Wax spacer and placement of catheters.

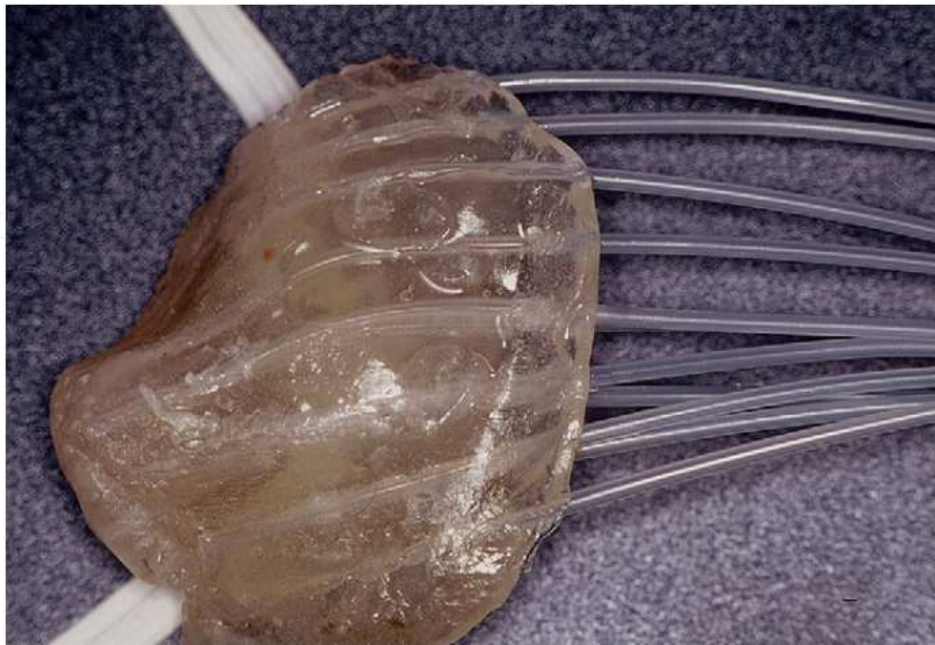Fig. 8. Two catheters were superimposed in irregular areas.

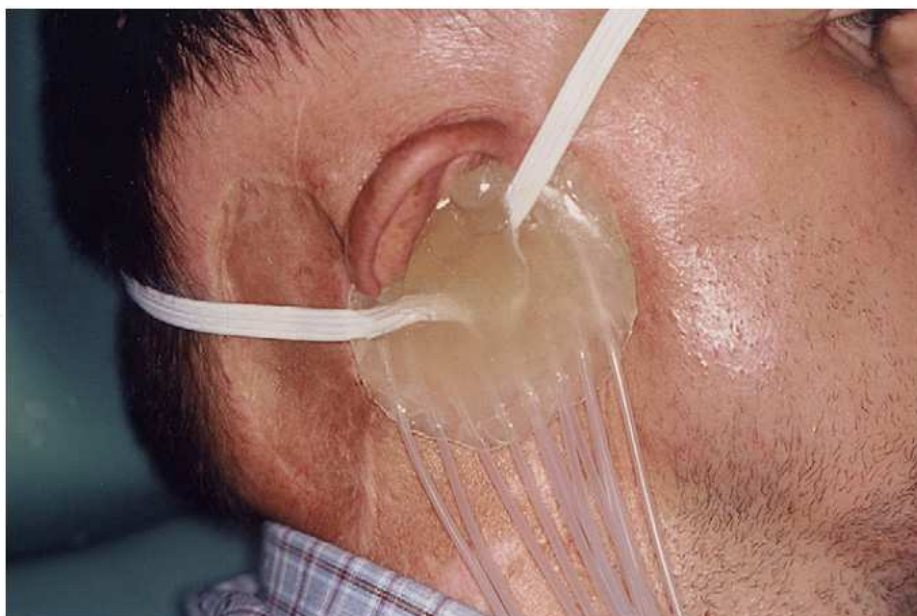Fig. 9. Wax spacer removed and replaced with soft-lining material.

Fig. 10. Adaptation of brachytherapy appliance to target tissues.

3.3 Case report 3: High dose rate mold brachytherapy of early gingival carcinoma

The purpose of this clinical report is to present the use of mold brachytherapy in the management in gingival cancer.

Gingival carcinomas are rare, constituting less than 2% of all head and neck tumors.[33] Surgery with intraoral resection of the tumor or wide excision with the underlying bony structures is the most preferred treatment approach.[33] Radiation therapy is used as an adjunct to surgery and is the primary treatment modality in inoperable patients.[33,34] Radiotherapy can be applied either through external beam or by brachytherapy. However, mold brachytherapy is rarely used in the management of the head and neck tumors, it is a promising method with encouraging results.[35] It has the advantages of low acute radiation morbidity and shortened treatment period compared with the external beam technique.

3.3.1 Patient 1

A 70-year-old edentulous woman was seen by her dentist with the complaint of ill-fitting dentures, which had been experienced for 2 months. A tumoral lesion that measured 25 × 15 mm was detected in the left maxillary gingiva. A biopsy was performed on the lesion (Fig. 11); histopathologic examination of the specimen was consistent with well-differentiated squamous cell carcinoma. She denied use of alcohol or tobacco, and it was learned that she had been wearing dentures for more than 30 years. The computerized tomography (CT) of the primary tumor and neck region showed no abnormality. The patient was staged as T2NOMO cancer of the maxillary gingiva and referred for primary radiation therapy. High dose rate (HDR) mold brachytherapy was applied, considering the size, site, stage and differentiation of the tumor, and age of the patient (Fig. 12).

Brachytherapy was well tolerated without any acute side effects. Grade IV mucositis was observed immediately after the treatment and healed completely in 1 month. Complete regression of the tumor was observed 1 month after the treatment (Fig. 13). The patient is alive and disease-free 36 months after the treatment.

Fig. 11. Tumoral lesion at left side of maxillary gingiva before brachytherapy.

Fig. 12. Application of mold brachytherapy.

Fig. 13. Lesion from Figure 2, 1 month after brachytherapy, shows complete response.

3.3.2 Patient 2

A 84-year-old edentulous woman with a 6-week history of an ill-fitting denture was admitted to the hospital at Hacettepe University. Physical examination revealed a tumoral mass that measured 30 × 15 mm on the maxillary left gingiva and leukoplakia on the neighboring mucosa. A biopsy specimen of the lesion disclosed moderately differentiated squamous cell carcinoma. There was no pathologic lymph node on physical examination and CT scan. The patient had a history of using dentures for the last 26 years and no history of alcohol or tobacco consumption. The patient was staged as T2NOMO carcinoma of the maxillary gingiva and referred to radiation therapy. Brachytherapy by customized dental mold was planned. No acute side effects were observed. However, grade III mucositis developed after the completion of treatment. Although complete resolution of tumor was achieved, the patient experienced dyspnea due to pleural effusion at the sixth month of follow-up. Her condition gradually deteriorated and she died of intercurrent disease with pleural metastases 6 months after the brachytherapy.

3.3.3 Procedures

3.3.3.1 Dental mold

Irreversible hydrocolloid impressions of the maxillae were made for both patients and custom trays were fabricated onto the obtained cast. Final impressions were made with a medium viscosity additional cure silicone material (Coltene/Whaledent Inc, Mahwah, N.J.) and were poured in type III dental stone (Amberok, Ankara, Turkey). After trimming the post-dam area, 2 layers of modeling wax were heated and adapted onto the cast to obtain a uniform thickness denture base. The cast was then flasked, the elimination of wax was accomplished with hot water, and heat-cured acrylic resin (Meliodent Bayer, Newbury, Berkshire, U. K.) was used to process the stent. After deflasking and trimming away excess material, the tubes that would transport the radioactive source to the target site were placed into the resin base preserving approximately 10 mm distance between each other. Two plastic tubes of 6F diameter for the first patient (Fig. 14) and 4 tubes of the same types were used for the second patient (Fig. 15). Grooves were formed on the base to allow the tubes to closely contact the mucosa at the target site. The tubes were ending at the border of the target site and secured with clear autocuring acrylic resin.

Fig. 14. Impression of maxillary gingiva and tumor using irreversible hydrocolloid paste (right) and acrylic resin dental mold with 2 6F plastic catheters incorporated within it, parallel to gingiva (left).

Fig. 15. Impression of maxillary gingiva and tumor of second patient (right) and acrylic resin dental mold with 4 6F plastic catheters incorporated (left).

3.3.3.2 Brachytherapy

Position of the dummy sources within the tubes were verified by simulation. Dosimetric calculations were performed by using the Plato Nucletron planning system (module BPS, Nucletron B.V., Veenendaal, The Netherlands). Irradiation was delivered by an Ir-192 HDR micro Selectron Afterloading unit. A total of 40 Gy was administered in 4 Gy fractions twice daily in 10 fractions and overall treatment time of 5 days for both patients. Special intraoral shielding lead blocks were used to shield buccal mucosa and tongue. Biologically equivalent doses for both patients were calculated to be 56 Gy10 for the tumor and 120 Gy2 for the late reacting tissues. Reference dose rate was 264.6 cGy/min and total air kerma was 0.06 cGy at 1 m for the first patient and 162.7 cGy/min and 0.12 cGy at 1 m for the second patient. The active length of both sources were 2.5 cm and the dimensions of the specified reference dose volume was 3.5 × 2.5 × 1.5 cm for the first patient. Active length of the sources were 4.25 cm for 1 source and 4.75 cm for the remaining 2 sources of the second patient. The specified reference dose volume was 4 × 4.5 × 3.5 cm for the second patient.

3.3.4 Discussion

Gingival carcinomas are rare tumors and optimal treatment modality is not settled yet. Early lesions are mostly treated with surgery, the role of definitive radiotherapy in these cases is unclear. External beam radiotherapy is generally used postoperatively or rarely as a primary treatment in advanced lesions.[33,34] Mold brachytherapy experience in oral cavity carcinomas is mostly with low dose rate brachytherapy.[35-37] There are few reports in the literature on the use of HDR mold brachytherapy combined with or without external beam therapy and the optimal time; dose and fractionation for HDR brachytherapy has not yet been determined.[38-40] In 1 of these reports, an early carcinoma of the nasal vestibule was treated with HDR mold brachytherapy and treatment parameters of this patient were similar to our patients.[7] After an extensive literature review, only 1 report was found on the use of dental molds with HDR remote brachytherapy.[41] Eliminating the morbidity of surgery, preserving the function of major salivary glands, being an outpatient treatment procedure, and allowing simple repeated noninvasive treatments are the advantages of HDR mold brachytherapy. Inadequate previous experience is the major disadvantage of this technique. Although the follow-up period is relatively short, these patients seemed to indicate that HDR mold

brachytherapy alone may be used in the management of small volume cancers of the gingiva with satisfactory local control. It was presumed that brachytherapy may be used as a boost method after external beam radiation for larger lesions. Because there is not enough experience and data in oral cavity cancers of HDR brachytherapy, more patients should be treated to determine the optimal dose and fractionation.

3.3.5 Summary

Two elderly edentulous patients with the diagnosis of early stage cancer of the upper gingiva were treated by customized dental mold brachytherapy. Locoregional tumor control was achieved in both patients. One patient is alive without any evidence of disease 36 months after treatment, the other patient died of distant metastasis shortly after brachytherapy. Brachytherapy, being easy to apply with short treatment time and good acute tolerance, is a good choice and effective modality for the management of early stage gingival cancer, particularly in elderly patients.

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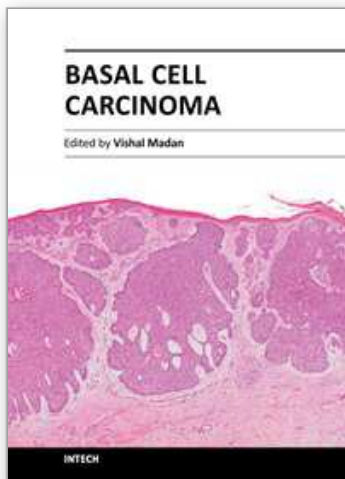
Basal Cell Carcinoma

Edited by Dr. Vishal Madan

Basal cell carcinoma is the commonest cutaneous malignancy. The last decade has witnessed exponential research which has broadened our understanding of the pathogenesis of basal cell carcinomas. This is also important from a therapeutic point of view as targeted approach to therapy is now being increasingly experimented. Although it is impossible to condense and present all good research in one book, the authors have to be commended on presenting their research on several aspects of basal cell carcinoma in a succinct manner, which shall not only enhance our understanding of, but also hopefully via this open exchange of ideas pave ways for successful targeted therapy of the commonest human cancer.

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