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CLINICAL REPORT

A Customized Finger Brachytherapy Carrier

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Abstract In recent years, radiation therapy has been used with increasing frequency in the management of neoplasms of the head and neck region. Brachytherapy is a method of radiation treatment in which sealed radioactive sources are used to deliver the dose a short distance by interstitial (direct insertion into tissue), intracavitary (placement within a cavity) or surface application (molds). Mold brachytherapy is radiation delivered via a custom-fabricated carriers, designed to provide a more constant and reproducible geometry for source positioning. Radiation carriers are customized to fit the patient in a comfortable, stable, and retentive manner to ensure maximal therapeutic radiations to the desired location and in addition sparing the normal surrounding tissues due to rapid fall-off radioactivity thus minimizing postreatment sequelae of irradiation. This clinical report describes a method of fabrication of a customized radiation carrier or mold for a patient suffering from squamous cell carcinoma of right ring finger, planned to undergo brachytherapy (surface mold therapy). This paper highlights the role and responsibility of the prosthodontist in fabricating the carrier and to maintain the predetermined position of the hollow tubes (catheters) within the mold to remain in the exact position as determined by the radiation oncologist for required results.

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Squamous cell carcinoma is the most common malignant tumor of the hand, accounting for 58–90 % of all hand malignancies. Both surgery and radiation therapies are used in treatment of squamous cell carcinoma. If an adequate margin of normal tissue can be obtained, surgery is the usual treatment, followed by radiation therapy [1]. Alternatively, radiation may be used as a primary treatment followed by surgery salvage.

Radiotherapy can be applied by external beam also known as brachytherapy. Brachytherapy is commonly used as an effective treatment for cervical, prostate, breast and skin cancer and can also be used to treat tumours in many other body sites [2, 3]. Brachytherapy can be divided into multiple categories: interstitial, intracavitary, intraluminal, and surface applicator techniques. In addition, the application can be further subdivided depending upon the loading technique-preloading or after loading, the dose rate-low dose rate or high dose rate and duration of the implant-temporary or permanent [4]. In interstitial brachytherapy, the radioisotope is placed temporarily or permanently into the tumour site. Intracavitary or intraluminal brachytherapy entails temporary application in a natural cavity near the tumor bed [5]. Surface application has been more commonly applied intraoperatively after a gross total resection to the exposed tumor bed while shielding adjacent normal tissues.

Advantages of brachytherapy include the precise targeting of the radiation which spares the healthy tissue, short treatment duration and little to no impact on the patient's quality of life. Treatment times are typically short, providing convenience to the patient. It has been suggested that brachytherapy may become a standard of treatment for skin cancer in the near future.

Prosthetic removable devices are usually indicated during the brachytherapy treatment. Mold brachytherapy is a radiation delivered via a carrier device known as a mold

[6]. It is usually delivered by custom-fabricated carriers designed to provide a more constant and reproducible geometry for source positioning. Radiation carriers are customized to fit the patient in a comfortable, stable, and retentive manner. The main purpose of such devices is to bring Iridium-192 needles for brachytherapy in close contact to tumor site. Prostheses used for radiotherapy have been described and classified as locators, stents, and carriers. Radiotherapists recognize that treatment with these aids is easier and more accurate. The primary advantage is that a high radiation dose can be given to the tumor while sparing the surrounding normal tissues [4]. It is of utmost importance that the hollow tubes (catheters) which are placed within the mold should remain in exact position as 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 brachytherapy radiation carrier device to ensure delivery of therapeutic radiation for the treatment of early stage squamous cell carcinoma of the right ring finger.

Clinical Report

A 52 year old male patient was reported to the Department of Radiotherapy, Govt. Medical College and Hospital, Patiala, with chief complaint of non healing ulcerative lesion over right ring finger since two and half years. On examination a non tender and painless ulcerative lesion of size approx 2 × 1.5 cm was found with indurated and jagged margins. (Fig. 1). The lesion was biopsied and diagnosed as squamous cell carcinoma. Thorough physical examination and biochemical investigations were done to rule out any metastasis. As the carcinoma was in the stage of T1N0M0 the treatment planning was to provide radiation therapy via mold brachytherapy radiation carrying appliance. For the fabrication of radiation carrying appliance, the patient was referred to the Department of Prosthodontics, Governmental Dental College and Hospital, Patiala.

On clinical examination of the patient, it was observed that the patient's defect was rough and irregular in size. (Fig. 1) Due to the nature of the defect, it was necessary to take measures to ensure retention, comfort, and stability while fabricating the prescribed carrier.

Procedure

Impression Making and Cast Fabrication

1. Impression of finger was made with irreversible hydrocolloid impression material using water measuring plastic cylinder. Plastic cylinder was selected such that it provided approx. 3 mm of space for alginate material all around the circumference of ring finger. It was chemically disinfected using 2 % glutaraldehyde solution.

2. For retention of irreversible hydrocolloid to the plastic cylinder alginate adhesive was applied to the plastic carrier. Alternatively, holes can be made in the plastic cylinder. (Fig. 2)

3. Care was taken so that the tip of the finger not to come in contact with the cylinder during impression making. To ensure this accurate placement of the finger to the appropriate depth, marking can be done on the finger. As the lesion was painless there was no discomfort while making the impression.

Fig. 1 Lesion on the finger

Fig. 2 Impression making

4. The Impression was rinsed and disinfected with (2 % Glutaraldehyde) solution and poured in type III dental stone (Kalstone, Kalabhai) to prepare the working cast. (Fig. 3)

Markings and Exact Placement of Hollow Tube Catheters

5. A thin layer of modelling wax (0.5 mm) was adapted on the cast to provide relief during the fabrication of radiation carrier with autopolymerising acrylic resin. The relief provided prevented the acrylic resin to come in direct contact with the tumour area.

6. With a marker, the exact dimensions of the tumour area were marked on the cast.

7. Longitudinal grooves were placed in the already adapted modelling wax, duplicating the exact location of catheters to be used for delivering radiation. The number and location of grooves were determined by the radiation oncologist. These grooves were placed approximately at a distance of 1 cm from the margins and from each other.

Fabrication of Mold

8. For easy separation of the appliance from the cast a separating media (tin foil substitute, cold mold seal) was applied over the entire cast. The carrier tubes were placed in the grooves in exact alignment as determined previously. They were secured in place with sticky wax. (Fig. 4) Alternatively micro pore adhesive tapes can be used for securing carrier tubes. Small amount of cold cure resin was added onto the tubes to maintain their exact position.

Fig. 3 Cast obtained

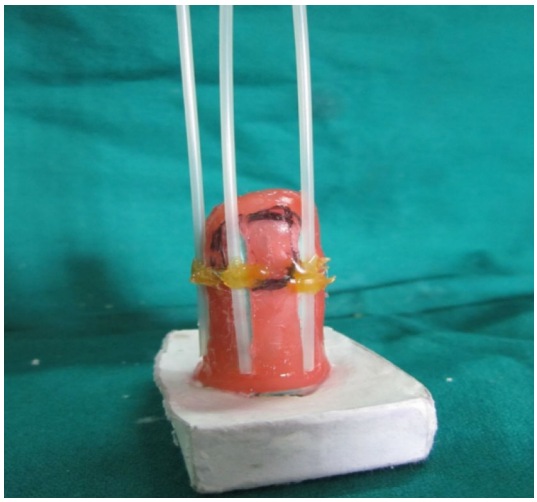

Fig. 4 Hollow tubes placed in predetermined location stabilized with sticky wax

Fig. 5 Radiation carrier appliance

9. The appliance was prepared with autopolymerising acrylic resin (DPI-RR cold cure) and finishing and polishing was done. (Fig. 5)

10. The appliance was assessed on the patient's finger and checked for adequate retention and comfort. (Fig 6)

Thus, a customized finger brachytherapy carrier was fabricated fulfilling all the objectives and goals which help the patient to undergo brachytherapy treatment for the scheduled dosimetry without any delay.

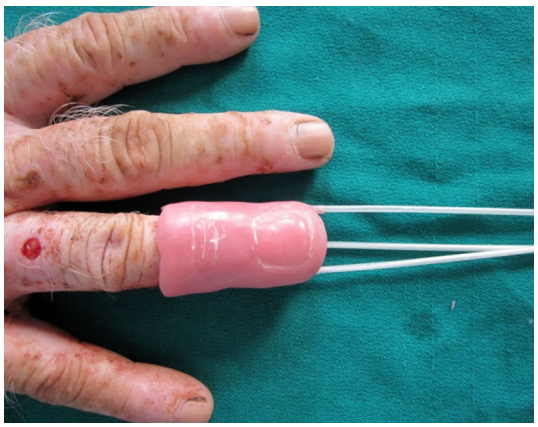

Fig. 6 Appliance assessed on the site

Discussion

Radiotherapy has been used in the treatment of numerous skin malignancies but accurate positioning of radioactive source and correct dose delivery to treatment area is difficult. The use of custom-made acrylic resin radiation appliance can be a valuable adjunct to the radiation treatment of cancers [7]. The carrier appliance should have good retention, stability and support which ensures maximal therapeutic radiations to the desired location. As the plastic tubes are positioned in the exact location determined by physicist and oncologist, the close proximity of the radiation source to the lesion limits the radiation scatter, in addition sparing the normal surrounding tissues due to rapid fall-off radioactivity. This minimizes post-treatment sequelae of irradiation and other side effects of radiotherapy [3]. The delivery of radiotherapy through this appliance reduces discomfort of both oncologist and patient due to short immobilization period. Radiation exposure of treating and nursing staff is eliminated. The technique for fabrication of radiation carrier requires materials that are readily available and there is no need for expensive equipments. Minimal clinical time is required for the carrier fabrication and appliance can be given to the patient in a single visit, hence treatment of the patient is not delayed.

Summary

This clinical report described a method of fabrication of a customized radiation carrier for a patient who has to undergo brachytherapy treatment for squamous cell carcinoma of right ring finger. This paper highlighted the role and responsibility of the prosthodontist in fabricating the radiation carrier and to maintain the predetermined position of the hollow tubes (catheters) within the mold as determined by the radiation oncologist for the required results.

References

1. Beumer J, Curtis TA, Marnick MT (1979) Maxillofacial rehabilitation: prosthodontic and surgical considerations. Medico Dental Media Int, St. Louis, pp 23–40
2. Cengiz M, Ozyar E, Ersu B, Akyol FH, Atahan IL (1999) High dose rate mold brachytherapy of early gingival carcinoma: a clinical report. J Prosthet Dent 82:512–514
3. Chalian V, Drane JB, Standish SM (1971) Maxillofacial prosthetics vol 1. Williams & Wilkins, Baltimore, pp 251–256
4. Ersu B, Hekimoglu C, Ozyar E, Aslan Y (1998) A hinged flange radiation carrier for the scalp: a clinical report. J Prosthet Dent 79:369–371
5. Sharma A, Kurtz KS, Schweitzer KM, Silken DR, Beitler J (2005) A customized orofacial brachytherapy carrier: a clinical report. J Prosthet Dent 93:24–27
6. Stuart C, White, Pharoah MJ (1998) Oral radiology, principles and interpretation, 6th edn. Mosby, St. Louis, p 409
7. Sela M, Taicher S (1983) Intraoral radiation carrier for edentulous patients. J Prosthet Dent 50:815–817 Dec 1983