Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/wvftff34

BRACHYTHERAPY RADIATION STENT FOR MUCOEPIDERMOID CARCINOMA– A CASE REPORT

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ABSTRACT
Direct application of radioactive sources to the cancerous site is known as brachytherapy, or BT. The target volume center receives high-dose radiation delivery using this approach, which is marked by a steep dose gradient while the surrounding healthy tissues are spared.
A 30-year-old female patient reported to the Department of Prosthodontics with a lesion in the palatal region. The lesion presents as mucoepidermoid carcinoma of the hard palate. The patient was referred from the Department of Oncology for the provision of a radiation carrier stent for interstitial brachytherapy of the hard palate for conventional radiotherapy. A brachytherapy radiation stent was fabricated for the hard palate for focusing the radiation in the specific region of the lesion.

Keywords: #Brachytherapy; #Maxillofacial prosthesis; #Radiation stent; #mucoepidermoid carcinoma, #palatal mucosa.

INTRODUCTION
Malignancies of the salivary glands are rare; they account for about 0.5% of all neoplasms and 5% of head and neck tumors. Mucoepidermoid carcinoma (MEC) is a frequent type of cancer that arises from the minor and major salivary glands. It accounts for around 29 to 34% of all carcinomas.[1].The phrase "mucoepidermoid tumor" was first used in 1945 by Stewart, Foote, and Becker [I] to characterize a peculiar salivary neoplasm that had mucus-secreting and epidermoid cells and was believed to have originated in ducts of salivary glands. [I] A single layer of mucus-secreting columnar cells bordered well-developed grandular or microcystic structures in low-grade mucoepidermoid carcinoma. Certain papillary infoldings created by either epidermoid cells or an intermediate-type cell with basaloid-like characteristics surrounded these cystic regions. [2]

Radiotherapy (RT) for the treatment of head and neck cancer has long been a standard approach with the objectives of eliminating the pathology and preserving organ function. When treating head and neck tumors, external beam radiation therapy (EBRT) is recommended as a definitive option in

conjunction with chemotherapy or as an adjuvant following tumor excision. In external beam radiotherapy, it is difficult to protect organs, especially in locally advanced tumors. [(3)] Brachytherapy is a form of radiation therapy used to treat cancer by delivering targeted radiation directly to the tumor site. Unlike external beam radiation therapy, which directs radiation from outside the body, brachytherapy involves placing radioactive sources inside or very close to the tumor. This allows for higher doses of radiation to be delivered with minimal impact on surrounding healthy tissues.[(3)] Interstitial Brachytherapy are radioactive sources implanted directly into the tumor. Intracavitary Brachytherapy are Radioactive sources placed in a cavity near the tumor, such as the cervix or uterus. Surface Brachytherapy are used for skin cancers, where the radioactive source is placed on the surface of the skin.

Advantages of brachytherapy includes the following,

- Precise targeting minimizes damage to healthy tissues.
- Can be a single treatment or part of a combination therapy.
- Short treatment time and often less recovery time compared to traditional radiation therapy.[(3&4)]

Maxillofacial stents are devices constructed to cover tissue and/or teeth for their protection; carry drugs and/or radioactive materials; control bleeding; or guide the insertion of dental implants. We can classify them as follows: Radiation carriers led to protective devices, tongue-depressing devices, positioning devices, and tissue-remodeling devices. [(4)]Radiation carriers transport radioactive sources closer to the lesion, making it possible to provide a concentrated radiation dose using capsules, seeds, tubes, or needles to a small region. This reduces the risk of radiation damage to nearby healthy tissues. When using sealed radioactive sources for interstitial, intercavitary, or surface application, the dose of radiation used in brachytherapy is applied in close proximity to the lesion. Brachytherapy prosthetics can be categorized as splints, carriers, shields, stents, or positioners. [(4)]

CASE REPORT

A 30-year-old female patient was referred to the Department of Prosthodontics for the provision of a radiation carrier for a lesion present in the hard palate for radiotherapy. Initially, the patient reported to the Department of Radiology for the lesion in the hard palate.The patient was diagnosed with low-grade mucoepidermoid carcinoma of the minor salivary gland by biopsy and histological examination. The lesion size was around 1.3x2x1.5 cm present in the hard palate region. The lesion was graded low-grade mucoepidermoid carcinoma histologically. A single layer of mucus-secreting columnar cells bordered well-developed grandular or microcystic structures in low-grade mucoepidermoid carcinoma. Certain papillary infoldings created by either epidermoid cells or an intermediate-type cell with basaloid-like characteristics surrounded these cystic regions [(2).]

Anteriorly the lesion extended till the rugae region, medially to the mid-palatal region, posteriorly till the molar region, and superiorly the lesion extended near the nasal floor region. Surgical excision of the lesion will cause extensive oro-nasal communication. Considering the age of the patient and the low-grade nature of the carcinoma, conservative management using brachytherapy was used instead of surgical excision as it might cause significant functional impairment. Concentrating the radiation dose to the sight of the lesion requires a radiation carrier. Commercially available radiation carriers usually pose challenges in fitting to individual patients. So, a custom-made radiation carrier stent was sorted by the Department of Radiation Oncology.

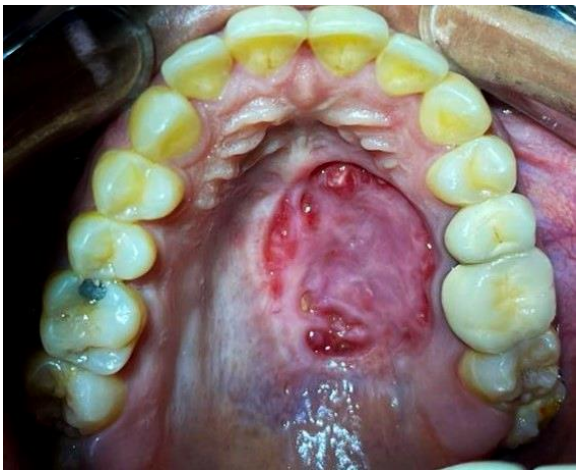

Fig.1 Lesion Present In The Palatal Region

Patient was planned for EBRT of 1000Gy /30 with 12 doses of concurrent carboplatin on consecutive 6days.

METHOD OF FABRICATION

For fabrication of radiation stent a diagnostic impression of maxillary and mandibular arch was made using irreversible hydrocolloid. Cast was fabricated using Type III gypsum. Along with the radiologist, planning was done for the proximity of the brachytherapy mould and position of the catheters was decided.

Fig2.10mm Wax Pattern Made For The Stent

Maxillary stent was fabricated using clear heat polymerized polymethyl methacrylate resin under 3:1 powder and liquid ratio with long curing cycle of 8 hours and bench cooling for 1 hour. A clear transparent maxillary stent was obtained for clear vision of the lesion through the stent and for the ease placement of catheters. Brachytherapy catheters (Flexible Implant tubes, Nucletron BV, Netherlands) were placed on the stent. Initially 4 cathethers were planned 5mm away from each other. After CT evaluation, 3 dummy catheters were planned with same distance. The tube channels were made in the stent and covered with wax sheet for easy removal and reuse of the same catheters for the following radiation exposure for 6 consecutive days of the same patient. The stent is 10mm in thickness which helped in depressing the tongue. The airway was maintained using a Oropharyngeal airway or Guedel pattern airway

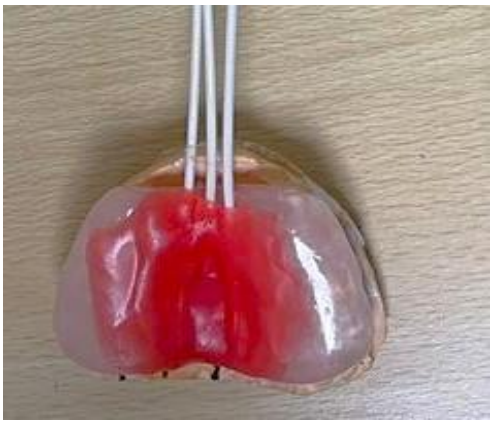

Fig3. Radiation Stent Attached With Catheters

Fig4. 10 Mm Acrylic Stent

Fig 5- Stent Try In Done Intra-Orally

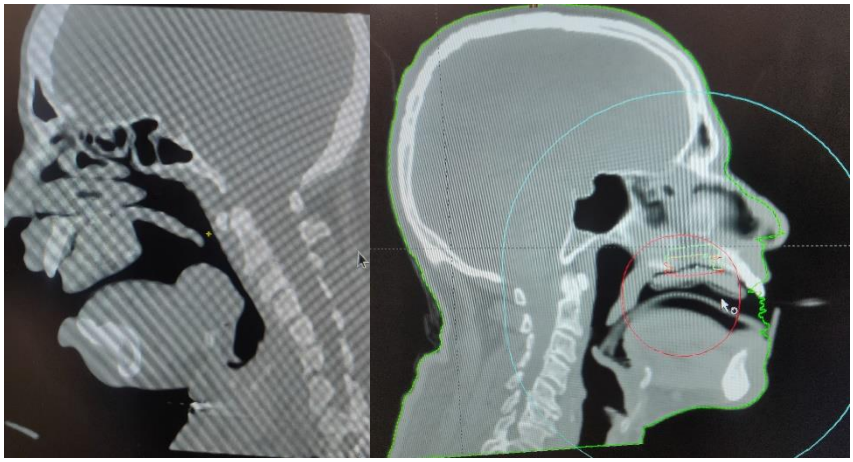

Fig. 6 - Computed Tomography Scan Showing Stent In Position With Radioactive Source Planning**.**

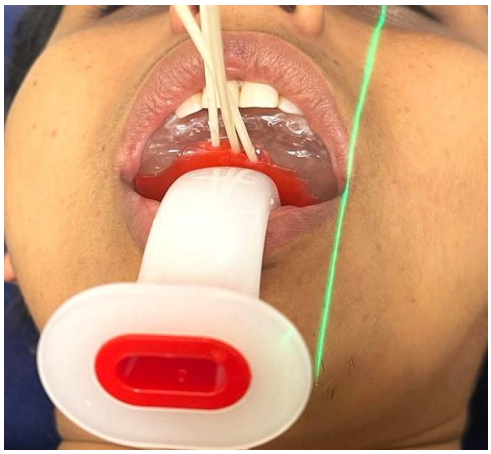

Fig 7.Radiation Stent Placed In Position With Oropharyngeal Airway

Fig 8.Healing Of Lesion After 2 Months of follow up.

Try-in of the prosthesis was done and the position and proximity was verified using CT. Once the position was verified the patient underwent interstitial brachytherapy as prescribed. Radiation dose of 1000 Gy was delivered in 12 exposure 2 exposure per day for the consequtive 6 days. Inorder to achieve maximum effect high amount of dose is given in small units on 12 exposure for 6 days. The stent will be used for repeated exposure of the patient with new catheter tubes

DISCUSSION

Head and neck cancer (HNC), in particular, accounts for 30% of all cancer case [6] .External Beam Radiotherapy is the most common treatment modality for the treatment of head and neck cancer. However, it becomes challenging as the radiotherapy causes complications and damage to critical structures as a result. The adverse effects of radiation therapy include mucositis, ulceration, salivary gland dysfunction and trismus. Brachytherapy helps protect the vital structures and allows high-frequency radiation towards the cancer site. Prosthesis such as positioning devices, and tongue depressing in conjunction with brachytherapy shield the tissues.[5] Patient reported to the Department of Prosthodontics with a lesion in the posterior palatal area measuring 2x1.5 cm. intra oral findings showed the presence of metal ceramic crown with relation to 25,26. Diagnostic impression was made using Reversible hydrocolloid impression material. Maxillary stent was first fabricated with thickness of 10mm for maintain distance from the lesion and for the provision of brachytherapy catheters. The stent for fabricated by covering the occlusal surface of the teeth for support of the prosthesis. For the placement of brachytherapy catheters, radiologists requested to provide channels for the catheters for it to be reusable. Hence, catheters channel was created in the palatal region with 5mm separation between the each tubes and then covered with wax sheet for securing the tubes.

The acrylic stent with 10mm thickness prevent the high dose concentration in the lesion area and avoid necrosis. It also helps in mouth opening and keep the tongue away from the region of irradiation.[7,8] Randal et al,[6] in his article laid down objectives of radiation carriers, as – (1) the carrier should reproducibly conform to the anatomy, (2) allow fixation of the catheters and (3) Should be comfortable enough to wear for several days. Hence, the radiation carrier meets all the above criteria along with additional features of providing reusable catheters [9] For low grade carcinoma brachytherapy can be considered as an alternative before undergoing complex surgical excision of the tumor. Two months follow of the patient showed reduced lesion size and healing of the mucosa. Brachytherapy can be used as an adjunct in preliminary treatment options. Brachytherapy is an effective option for many patients, and its use continues to expand as techniques and technologies improve.

CONCLUSION

A radiation splint is a prosthetic device that enables brachytherapy treatment of intra-oral cancers. With the help of these customized prosthetics, the damaged area can get a concentrated radiation dose while the other parts are spared. Their use during radiotherapy should be systematic if indicated with the concertation with the oncological team. Collaboration between the maxillo-facial specialist and the radiotherapist/oncologist guarantees good treatment for cancer patients.

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