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Case Report

A simplified technique to fabricate tissue bolus device to manage dose distribution in maxillectomy patient with orbital exenteration

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ABSTRACT

The primary goal of radiotherapy is to deliver maximum dose to tumor but minimal dose to normal tissues. Irregular surfaces along with cavities sometimes make it difficult to deliver a homogenous radiation dose. Data incorporated in the delivery of prescribed dose are measured from the dosimetric system which are homogenous in nature, hence the exposed medium (i.e. tumor) should possess the same property in constituents and nature. At the inference of two different mediums, such as in case of cavity in the treatment field; there occurs build up and build down effects in dose delivery that may result into hot spot and cold spot. These cold spots may result in recurrences.

The aim of this paper is to fabricate a simple, cost effective tissue bolus device, which may be filled with normal saline to reproduce homogenous and regular medium at the time of radiotherapy.

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1. Introduction

As part of pre-radiation dental evaluation process, the maxillofacial prosthodontist is often requested to fabricate prosthetic radiotherapy devices. These devices are used to shield, displace, and position tissues in an attempt to reduce dose distribution heterogeneity along with radiation-induced tissue morbidity.¹ The prosthetic devices are usually made from acrylic resin and are fabricated prior to the radiation simulation appointment, to ensure that the radiation mask and calculated dosimetry take into account the

position of the tissues when the patient is wearing the device.²

Irregular tissue contours after maxillectomy and orbital exenteration creates heterogeneity in radiation dose distribution.³ As a result; some areas within the field of radiation may be under dosed while other areas may develop isolated hot spots. A bolus is a tissue-equivalent material placed directly on or in irregular tissue cavity to produce a more homogenous dose distribution.⁴

The aim of this paper is to fabricate a simple, cost effective tissue bolus device, which may be filled with normal saline to

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reproduce homogenous and regular medium at the time of radiotherapy.

2. Technique

A 35-year-male patient reported to our outpatient department, with previous surgical obturator and restricted mouth opening after left side maxillectomy and orbital exenteration (Aramany class 1).⁵ He was scheduled for radiotherapy (Figs. 1 and 2). The retention and stability of the surgical obturator was satisfactory. So, it was planned to form tissue bolus device on that obturator.

Urinary male catheter (Prabha surgical product, Allahabad, India) of large size 30 mm was selected to form a bladder in which saline was filled (Fig. 3). This dimensionally compatible catheter was blocked on one end with elastic band. The other end of the catheter was cut and adjusted according to the requirement and connected with a drip set tube and this tube was further connected to a 10 ml disposable syringe (Dispovan, Hindustan Syringes and Medical Devices Ltd., Faridabad, India) to fill the bladder with saline.

A hole was made on the palatal surface of obturator, using round tip acrylic bur, to insert drip set tube. This drip set was firmly attached to obturator at the hole. Now, the balloon was on the tissue side of the palatal surface of obturator. This device was inserted in the oral cavity and seated well with the help of retentive clasps. Saline was filled with 10 ml syringe into this balloon slowly till the fullness of both side of the face looked similar (Fig. 4a, b). Amount of saline (ml) was recorded to use same amount at every session of radiotherapy.

CT scan was done with tissue bolus device along with saline and radiopaque dye and without device to compare the fullness of the face bilaterally (Fig. 5).

3. Discussion

Following orbital exenteration and maxillectomy, irregular contours and air cavity make it difficult to determine dose

Fig. 2 – Orbital exenteration defect.

distribution, particularly when the size of air spaces resulting from these surgical procedures, is greater than the entry points through the orbit or palate. Tissue in greatest jeopardy of radiation injury are skin grafts within the defects, broad areas of thin mucosa over bone, and brain tissue in close approximation to the posterior borders of the defect.⁶

A variety of methods have been employed to restore tissue density to facilitate radiation therapy. The placement of thermoplastic material such as paraffin wax in the defect has been an option but irritation of tissues during insertion and removal as well as air spaces between the segments made it impractical in this case.

Gauze bolus soaked in water is another method to restore lost tissue density. But, water seepage through nasal passages into the pharynx may lead to discomfort, coughing and aspiration. Normal saline has also been used previously to restore tissue density in maxillary defect air spaces.⁷ This modified technique used already fabricated surgical obturator with urinary catheter and drip set filled with normal saline. This method optimized the dosimetry by restoring tissue density throughout the defect, particularly of the margins, and ensured homogenous delivery of radiation to complex, irregularly shaped contours.

This device is easy to insert and can be repeatedly used in various fraction of radiotherapy. The material used in this technique is easily available, specially the urinary catheter available in different sizes, can be used in different age group patients. This device could be filled as well as deflated easily and accurately as required which is not possible with wax or

Fig. 1 – Aramany class 1 maxillectomy defect.

Fig. 3 – Tissue bolus device.

Fig. 4 – (a) Defect without device. (b) Defect with device.

Fig. 5 – CT scan with tissue bolus device.

gauze soaked in water. This helps in improving tissue contours as of the normal side.

Conflicts of interest

All authors have none to declare.

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