

Dose Agreement Analysis of Treatment Planning System-Calculated Doses and Markus Chamber-Measured Doses in the Near-Surface Region for Breast Cancer Patients' Conformal Treatment Plans

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Abstract

Background: Surface/skin dose measurement is one of the most challenging tasks for clinical dosimetry in radiotherapy and comparison with almost all the commercially available treatment planning systems (TPSs) brings a significant variation with the measured dose. **Aims and Objectives:** In the current study, doses calculated from the TPS in the near-surface region for conformal plans (both three-dimensional conformal radiotherapy [3DCRT] and intensity-modulated radiotherapy [IMRT]) of 35 breast cancer patients were evaluated and compared with the doses measured with Markus chamber. **Materials and Methods:** The computed tomography (CT) images of a solid water slab phantom with a Markus chamber (at different depths ranging from 1 mm to 5 mm from the surface) were taken and imported into the TPS. All the conformal treatment plans made in TPS were executed on a linear accelerator and dose agreements between TPS calculated and chamber measured doses were analysed. **Results:** Results showed that this TPS underestimated the calculated doses in the superficial region by up to 26% and 21%, respectively, with respect to mean and maximum dose values obtained within the effective volume of the chamber used. **Conclusions:** The uncertainty of doses in the superficial region should be kept in mind when evaluating treatment plans for superficial tumours in TPS.

Keywords: Breast cancer, conformal planning techniques, Markus chamber, solid water phantom, skin dosimetry, treatment planning system

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INTRODUCTION

The evaluation and determination of the skin doses are of major concern when it contains target volumes, especially in the near-surface regions, for example, chest wall irradiation in the breast carcinoma (Ca), Ca maxilla, Ca buccal mucosa, or other superficial tumors. Radiotherapy, apart from surgery and chemotherapy, plays a significant role in the treatment of breast cancer. Virtual dose simulations are carried out by the treatment planning systems (TPSs) using various dose calculation algorithms to acquire the best optimized conformal dose distribution.^[1] Underdosage to the target can result in recurrence of tumor while overdosage can lead to severe skin reactions. While modern TPS is, in most cases,

able to accurately predict doses for a patient, several studies have demonstrated inaccurate surface and near-surface dose estimation by TPSs.^[2-5] Hence, surface dose measurement is one of the important dosimetric tasks for the proper dose delivery to cancer patients where the target structures are superficial.

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