Medical Dosimetry, Vol. 34, No. 1, pp. 16-19, 2009

0958-3947/09/$–see front matter

doi:10.1016/j.meddos.2007.07.002

A TECHNIQUE FOR VERIFICATION OF ISOCENTER POSITION IN TANGENTIAL FIELD BREAST IRRADIATION

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(*Received* 2 *March* 2007; *accepted* 20 *July* 2007)

Abstract—Treatment verification and reproducibility of the breast treatment portals play a very important role in breast radiotherapy. We propose a simple technique to verify the planned isocenter position during treatment using an electronic portal imaging device. Ten patients were recruited in this study and (CT) computed tomography-based planning was performed with a conventional tangential field technique. For verification purposes, in addition to the standard medial (F1) and lateral (F2) tangential fields, a field (F3) perpendicular to the medial field was used for verification of the treatment portals. Lead markers were placed along the central axis of the 2 defined fields (F1 and F3) and the separation between the markers was measured on the portal images and verified with the marker separation on the digitally reconstructed radiographs (DRRs). Any deviation will identify the shift in the planned isocenter position during treatment. The average deviation observed between the markers measured from the DRR and portal image was 1.6 and 2.1 mm, with a standard deviation of 0.4 and 0.9 mm for fields F1 and F3, respectively. The maximum deviation observed was 3.0 mm for field F3. This technique will be very useful in patient setup for tangential breast radiotherapy. © 2009 American Association of Medical Dosimetrists.

Key Words: **Isocenter position, DRR, EPID, Breast cancer, Tangential fields.**

INTRODUCTION

Breast irradiation is one of the most challenging problems in radiotherapy due to the complex shape of the target volume and its proximity to the surrounding normal structures. Treatment verification and reproducibility is an important step in radiotherapy to achieve better tumor control. Proper implementation of the planned parameter during treatment is essential, especially, verification of the planned isocenter position. Small deviations in the positioning of the patient with regard to the beam setup could have a relatively important impact on the treatment volume. Consequently, it is important to control the setup error during radiotherapy.[1,2] Electronic portal imaging devices (EPIDs) play a role in accomplishing the above task by studying the setup error and correcting the same before the treatment delivery.[3–6] Presently, EPIDs are used in radiotherapy for transit dosimetry. Verification of tangential field breast radiotherapy is done by direct comparison of the planned and executed treatment fields.[7–9] The routine method of verifying the isocenter position with anterior and lateral fields is not practically feasible in tangential field breast radiotherapy because of the large lateral separation.

In this study, a simple technique has been devised for checking the planned isocenter position during treatment of tangential field breast irradiation.

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METHODS AND MATERIALS

Ten patients with early breast cancer receiving postoperative radiotherapy were recruited in the study. All patients underwent CT scanning (Siemens Volume Zoom CT, Siemens Medical Solutions, Concord, CA) in treatment position with copper markers placed along the medial and lateral field borders for defining the CTV. The CT image datasets were transferred to the Eclipse treatment planning system (Varian Associates, Palo Alto, CA) through a network. Conventional tangential fields were planned using an isocentric technique for all patients applying 6-MV x-rays. The fields were asymmetric and the posterior beam edges of the medial and the lateral tangential fields were matched together to correct for divergence. For verification purpose, a third field (F3) perpendicular to the medial tangential field was added. Marker points were placed along the central axis on the skin surface of the medial tangential field F1 (Fig. 1) and field F3 (Fig. 2). DRRs were generated for fields F1 and F3. The distance between the central axis markers of fields F1 and F3 were measured on both DRRs (Fig. 3). The plan was then transferred to the Clinac 2300 C/D linac equipped with portal imaging device (liquid-filled matrix ionization chamber type). Once the patient setup was done, 2 lead markers were placed on the patient's skin surface; one along the central axis of the medial tangential field and the second along the central axis of field F3. Portal images were then taken for both fields F1 and F3, and the distance between the

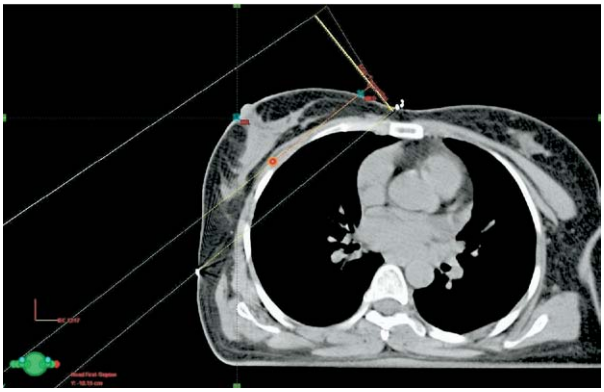

Fig. 1. Medial tangential field with marker placed along its central axis.

markers was measured and compared with that of the DRRs (Fig. 4).

RESULTS

Table 1 shows the results of the isocenter shift between the planned and executed treatment fields. The average difference of the distance between the markers measured from the DRR and portal image was 1.6 mm with a standard deviation of 0.4 mm, for medial tangential field F1, and 2.1 mm with a standard deviation of 0.9 mm, for field F3. The maximum observed deviations were 2.7 and 3.0 mm for fields F1and F3, respectively. The deviation observed was slightly larger for field F3 when compared to field F1.

DISCUSSION

Accuracy in patient positioning is a prerequisite to ensure precise coverage of the target volume. Positioning errors result both in underdosage of the target volume and unnecessary irradiation of normal tissues, leading to decreased local tumor control probability and an increase in side effects. Therefore, it is mandatory to check the

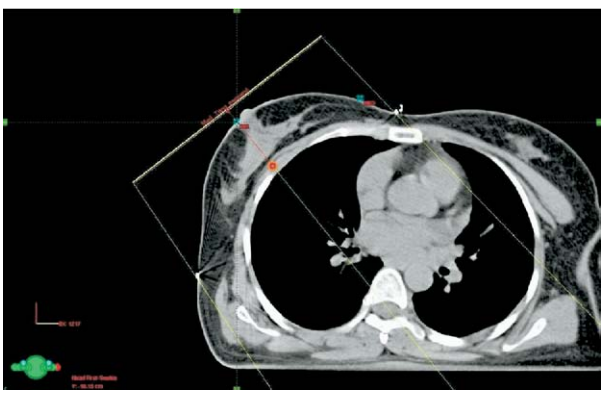

Fig. 2. Field F3 placed perpendicular to the medial field with marker along its CAX.

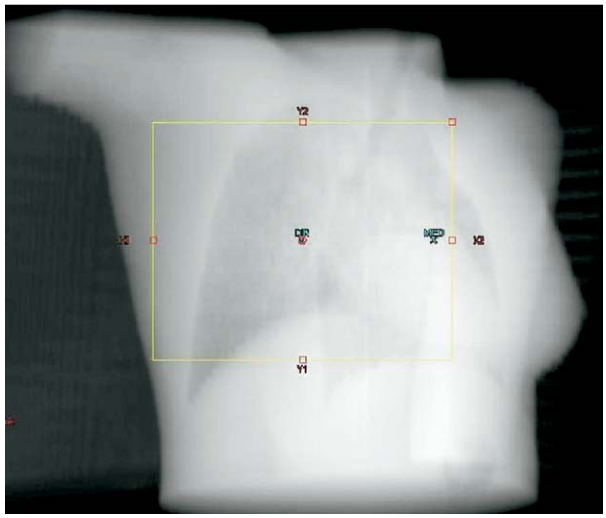

Fig. 3. DRR image of field F3 with markers.

field placement during treatment setup. The routine way of checking the isocenter position is by analyzing 2 perpendicular irradiation portals (anterior and lateral fields) for most of the cases. In case of breast, the marker will be obscured in the portal image for the lateral field because of the patient's lateral separation, and it will be difficult to check the isocenter position. The proposed method is easy to implement in verifying the isocenter position at the cost of adding an extra field to the conventional tangential field and 2 markers along their respective central axis. The important step in this procedure is to compare the distance between the markers seen on the DRR with the markers seen on the portal image for both fields.

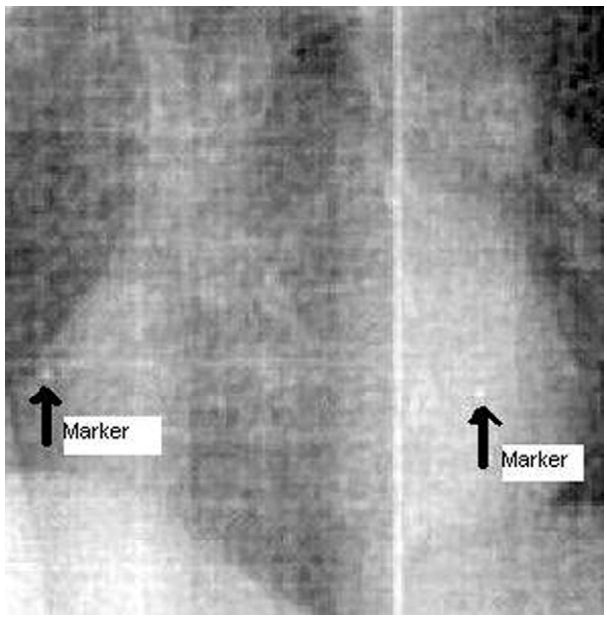

Fig. 4. Portal image of field F3 with markers.