

Radiotherapy treatment verification, tools and methods

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Radiotherapy verification is the process which enables that volume of interest is treating as it is planned. As accurate as the prescribed dose, should be delivered at the right place. So, in order to assess the quality of the radiotherapy treatment, geometric and dosimetric verification have to be done. The goal of verification is to check that the accuracy of the treatment is within the limits set by the uncertainty margin defined on the treatment plan.

The geometric localization can be done acquiring a control image of the patient in the treatment position and its matching with digitally reconstructed radiograph (DRR) obtained with the treatment planning system. For 3D geometric verification of the patient position, two control images perpendicular one to each other is necessary to be performed. The needed correction in three axis x, y and z are done automatically. Additionally for more precise 3D positioning on board Cone Beam Computer Tomography (CBCT) is used.

The dosimetric verification means: measuring the dose at some points inside the patient, and comparing it to the dose at the same points calculated and predicted by the treatment planning system. The most common methods for this verification used in 3D conformal radiotherapy are IN-VIVO for static and Portal dosimetry for dynamic dose delivery. IN-VIVO is making online during the treatment with diodes or ThermoLuminescence Detectors (TLD). Portal dosimetry is performed on the approved plan without patient using electronic portal imager device (EPID) for measuring and □ evaluation criteria for comparison. The matching of predicted and measured dose distribution shows their agreement and disagreement areas.

Moreover, because treatment verification in radiotherapy is an open process, CBCT is used for adaptive plan making. Copy the reference plan on CBCT allows us to see the real dose in the volume of interest and organs at risk (OAR) with uncertainties mostly from matching procedure.

Treatment verification in radiotherapy doesn't mean that the exact predicted dose on the exact place will be delivered during the treatment execution later on. But sure it provides decreasing of the uncertainties. Moreover, it helps to avoid radiation accidents.

Key words: in-vivo, portal dosimetry, cone beam CT, digitally reconstructed radiograph