ALTERNATIVE REGIMENS FOR TREATING PROSTATE CANCER USING EQUIVALENT UNIFORM DOSE AND MONTE CARLO METHODS

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Introduction. Conventional radiotherapy treatments are administrated with 2 Gy external beam radiotherapy (EBRT) fractions. It has been postulated that prostate cancer would respond to radiotherapy as a slowly proliferating late-responding normal tissue, benefiting from hypofractionated regimens. Highly conformed brachytherapy is a treatment option either alone or combined with EBRT.

Purpose. To identify alternative radiotherapy regimens for treating prostate cancer using EBRT and low dose-rate brachytherapy (LDRBT) with ^{125}I implants, biologically equivalent to conventional treatments in terms of uniform equivalent dose (EUD).

Materials and methods. The EUD concept was used, together with monte carlo (MC) methods. Two voxel phantoms were segmented from the computed tomography of patients to obtain the energy deposition derived from the MC simulations of EBRT and LDRBT treatments in a voxel-by-voxel basis. The energy deposition was converted in EUD. Equivalent regimens to EUDs of 72 Gy, 80 Gy, 90 Gy, and 100 Gy were determined for increasing fractions of 1.8–5.0 Gy and amounts of LDRBT from 0 Gy (EBRT exclusive) to 145 Gy. The resulting EUD for rectum was also evaluated.

Results. Alternative schemes equivalent, in terms of EUD, were obtained. For example, it is equivalent to an EUD of 72 Gy, 38 × 2 Gy, 20 × 3 Gy or 9 × 5 Gy of EBRT, or 6 × 5 Gy of EBRT plus 50 Gy of LDRBT. The rectum benefits of higher amounts of LDRBT for EBRT fractionations <2.5 Gy and larger fractions for LDRBT dose <50 Gy.

Conclusion. Alternative regimens for the treatment of prostate cancer with EBRT and LDRBT are proposed. The rational for the use of brachytherapy becomes less relevant with the increasing therapeutic ratio achieved with hypofractionated EBRT.

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NEW QUALITY CONTROL PHANTOM FOR STEREOTACTIC BODY RADIATION THERAPY USING RADIOCHROMIC EBT3 FILM

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Introduction. Stereotactic Body Radiation Therapy (SBRT) is an increasingly used technique. Due to its particular characteristics a patient specific quality control (QC) is mandatory to ensure an accurate dose delivery.

Purpose. To develop a dosimetry system consisting of a phantom for insertion of radiochromic films positioned in orthogonal directions for dose measurements.

Materials and methods. A full film characterization was performed, evaluating megavoltage radiation response, scanning symmetry, angle positioning, after radiation time dependence. Sensitometric curves were performed for a high dose range (1–40 Gy) with 6 MV photons.

A PMMA homogeneous and spherical shape phantom was developed, divided in four identical pieces allowing the positioning of the radiochromic films in an orthogonal disposal.

Several SBRT treatment plans (conformal, IMRT and VMAT) were measured for validation purpose. The comparison between the calculated and measured doses was made using the gamma index criteria (3%/3 mm) in an in-house software and compared with the results of a commercial system.

Results. Optimal conditions for film transmission scanning were obtained as well as the correction factors for high uniformity achievement.

The spherical shape of the phantom revealed to be advantageous allowing several non-coplanar irradiation angles. Due to the homogeneity of this phantom, heterogeneities problems associated to other commercial systems are not relevant.

The passing rate for the gamma index was >95% for the total points analyzed.

Conclusions. The developed phantom and the system characterization result in a suitable phantom/radiochromic system for SBRT plan dose QC. With a single irradiation, dose distribution in orthogonal planes is obtained, with the characteristic high spatial resolution of these films.

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A NOVEL METHOD FOR SUB-MILLIMETRIC DETERMINATION OF LASER-RADIATION ISOCENTER COINCIDENCE BY MEANS OF A COMPUTED RADIOGRAPHY SYSTEM

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Introduction. A procedure has been devised to check the coincidence of room lasers with the radiation isocenter of a Linac, by performing a starshot test on a Computed Radiography System (CR).

Purpose. Currently Winston–Lutz test, or a starshot film are the gold standard. However, the accuracy of these procedures relies on the skill of the staff member performing the check to precisely position a phantom or marking the film. We propose an observer independent method for conducting this test.

Materials and methods. A Konica CR System is used. The CR plate sensitivity to visible light will be used to accurately determine the laser position. We set the plate without its cover, so light can reach the active area. The plate is irradiated with an open beam that covers all the active area, with a low dose setting, to create a homogeneous background. The starshot pattern is generated by delivering nine 6 MV photon beams, 1 × 40 field size. The room lasers are switched