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Application of CT optical system for dose evaluation of Fricke gel solution

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Objective: This work aims to evaluate the Fricke gel solution as a method for three-dimensional dosimetry using an equipment of optical computed tomography VISTA 16.

Purpose: The technique of optical computed tomography has similarities with X ray CT, the difference is that optical CT utilizes visible light as the photon source. Both optical and X ray CT works with attenuation data acquired at various views through the object to be imaged. Optical computed tomography was developed as an alternative method for evaluating gel solutions for three-dimensional dosimetry [1]. The evaluation by optical computed tomography is performed by measuring the solution before and after irradiation. The application of mathematical algorithm of inverse problems is used for images reconstruction. The reconstructed images are used to evaluate the attenuation variation between before and after irradiation [2]. There is a correlation between attenuation variation and the dose deposited in material. The Fricke gel solution has been changed to become a radiochromic solution, i.e., have the property of undergoing changes in optical density as a function of the deposited dose. The xylenol orange added to the Fricke gel solution becomes a ferric ions (Fe^{3+}) indicator, resulting from the oxidation of ferrous ions (Fe^{2+}) radiation induced [3].

Materials and Methods: For this work it was proposed a solution Fricke gel modified with reduce in xylenol orange concentration for specified use in optical CT. The Fricke gel solution samples were irradiated with ^{60}Co gamma radiation in a Gammacell equipment with isotropic irradiation capacity.

Results: The evaluation in optical CT equipment VISTA 16 results images with alteration in pixel values that correspond to attenuation variation. In images it was possible verify the dose distribution uniformly that corresponds to the isotropic irradiation method.

Conclusions: The Fricke gel solution evaluated in optical CT shows a uniformity of the dose that was applied in the solution, being feasible to be studied for irradiation in radiotherapy equipment looking for its use in treatment planning.

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