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Development of Patient-Based 3D Dose Verification Tool Using of the Normoxic Gel, Film and TLD in Modern Radiotherapy

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Three-dimensional conformal radiotherapy (3DCRT) is one such method used to conform dose distributions to irregularly shaped tumor volumes while minimizing the dose to nearby critical structures. The measurement of complex dose distributions requires a dosimeter that can integrate the dose during a complete treatment. With increasing use of conformal dose distributions requiring shaped, non-coplanar beams, there will be an increased requirement for a dosimeter that can record and display a 3D dose distribution. Our center (KUMC) has self-developed 3D dose verify phantom (3DVP) of cranial and extra-cranial phantom to assist in the verification of 3DCRT treatment delivery. The 3DVP composed of phantom, dosimeter magazines and accessory. The gel dosimeter insert made of water and acrylic has been designed and constructed. The insert can be interchanged with an equivalent gel dosimetry container, film holder and TLD holder to increase accuracy of 3D dose distribution. This phantom has been used for the verification of 3DCRT dose distributions for head and neck and lung cancer treatments. The normoxic gel dose profiles of single beams agreed within 3% with the profiles measured with a 3 dimensional dosimeters (stack of film, stack of TLD). For the multi-beam conformal treatment, the difference dose profiles between normoxic gel and 3d dosimeters agreed within 5%. In conclusion, our results indicate that the patient-based 3D dose verification tool (3DVT) using of the normoxic gel, film and TLD is a promising method for dosimetric verification of 3DCRT.

Keywords : Gel Dosimetry, 3D Dose Verification Tool (3DVT), 3D Dose Verify Phantom (3DVP)