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Analysis of the Respiratory Motion Effects on Dose Distribution using TLD Phantom

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The delivery of highly conformal radiation therapy may be problematic in the presence of respiratory organ motion. Radiation delivery in the presence of internal organ motion caused an averaging or smearing of the dose distribution with motion over the path of the motion. The purpose of this study was to assess the dose delivery on moving organs such as liver and lung. Therefore, we made a phantom for thermoluminescent dosimeter (TLD) and investigated the dose distribution variation following respiratory motion using a moving system and the phantom for TLD. The TLD phantom shape was a cube of outer dimension 220 × 220 × 220 mm3. The phantom was mounted with ten slabs using the slab holder. Each slab was mesh shaped and contained a small hole for a TLD cube and had a certain interval. The TLD system consisted of LiF, type TLD-100 with Harshaw reader. We measured the beam profile of 6MV beams using a field size of 10 cm×10 cm with SSD of 100 cm. The moving system (Paker deal Inc., USA) moved the TLD phantom and controlled the moving control software. The reference state (non-moving state) was measured using the TLD phantom. The symmetry of the field size (10×10 cm2) was 2.7%. We measured the beam profile of the non-moving and moving (20 mm) states using the TLD phantom. To describe the respiratory organ motion in the right-left direction, the moving device moved in the x-axis direction. The dose delivery on the moving organ was assessed using the TLD phantom for the measured reference and moving state. The TLD holder slab, included in the TLD phantom, was able to control the position of the slab and TLD for practical dosimetry application. The study results presented here have described an appropriate QA method in respiratory gating radiation therapy.

Keywords : Respiratory Motion, Dose Distribution, Thermoluminescent Dosimeter