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Three-dimensional Dose Verification Using Normoxic Polymer Gel Dosimeters for Tomotherapy

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The aim of this study is to evaluate the feasibility of using MAGAT as a near real-time 3-dimensional dose measurement device for tomotherapy. MAGAT is a new type of normoxic polymer gel dosimeter, which responds well to absorbed dose and can be easily made in the presence of normal oxygen surroundings. Its dose response was measured by irradiating MAGAT-gel-filled testing vials with tomotherapy and its linear relationship with dose was present from 0 to 6.5 Gy. One group of gel samples were measured in near real-time, in which the gel phantom was read right after the irradiation. The other group was measured 12 hours after irradiation so the gel phantom can be exposed to oxygen. Several post-imaging processing filters including Nagao, Guess, median, mean, min and max, were applied on megavoltage computed tomography (MVCT) images for better discrimination on dose responses. Our results show that dose responses for MVCT with real-time and 12-hour delayed measurement were 4.76 and 4.69 ΔSI . cGy⁻¹, respectively, and show no significant difference (p-value = 0.72). For study of the filtering effects, Gauss, median and mean filters offer better linear correction coefficients of dose response. In conclusion, the MAGAT polymer gel dosimeter read from MVCT imaging is a promising method for dose verification in clinical tomotherapy.

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