MONTE CARLO SIMULATION OF 6 MV PHOTON BEAM CHARCTERISTICS WITH DOSIMETRIC FUNCTIONS FOR MEDICAL LINEAR ACCELARATOR APPLICATIONS

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Linear Accelerator (LINAC) is one of the most common devices used to treat cancer with external beam radiation. It uses high energy radiation beams or photons ranging from 5 to 25 MV to destroy a cancer. In such treatment practices, estimating the most accurate dose and locating the exact treatment position are the common challenges. Monte Carlo calculation for external beam radiation transport can be a useful technique to estimate the properties of the LINAC. The study developed a virtual simulator in MATLAB using Monte Carlo method for dosimetric functions of 6 MV photon beam. The simulated dosimetric functions were then compared with the estimated values from 6 MV photon beams generated by a clinical LINAC machine, Varian Clinac 2100C LINAC using water phantom measurements. Dosimetric beam parameters were generated for 10×10 cm^2 field. The study mainly analyzed percentage-depth-dose (PDD) and lateral dose profile, some key features of a high-energy photon beam. The percentage depth dose (PDD) is used to specify the beam quality for megavoltage radiation beams. Both simulated and estimated curves were normalized 100% at the depth of the maximum dose (d_{max}) on the central axis. Percentage depth dose showed an agreement between simulated and measured data at build up region with a close similarity in the shape of the curves. But there was an obvious difference at the surface region of both curves. Lateral dose profile is the variation of dose observed on a line perpendicular to the central beam axis at a particular depth. The simulated depth dose is slightly deviated from the expected graph as observed from water phantom experiment.
The differences observed in simulations may be due to the smaller number of photons used to reduce high simulation time with available computer power. In order to obtain statistically efficient simulations for photon beam with higher number of photons, preserving greater precision with less simulation time, variance reduction techniques can be used in the future.

Keywords: Monte Carlo Simulation, Percentage Depth Dose (PDD), Dose Profiles

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