Optimization of the Percentage Depth Dose for Linac Photon Beam Using Taguchi Methodology

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Abstract

Photon beam output from the medical linear accelerator (Linac) gives the enriched dose to tumor in deeper area and kills the tumor, and has the benefit of arising the skin sparing effect. In clinical, photon therapy has the excellent result in radiotherapy. Photon beam energy from the Linac used microwave to gets electron kinetic approaching the speed of light, the electron strikes the target to generate bremsstrahlung radiation. The parameters of photon energy are directly related to PDD. Generally, PDD rely on experience to adjust for the requirements of the physicist within 2% in clinical, resulting in wasted time and loss machine performance, after replaced the relevant parts, but do not understand the parameters of photon energy to take the time to verify machine or neglect the importance to caused clinical error. This study using taguchi method to optimize the parameters of photon energy with the least number of experimental conditions to reach minimum error of PDD, advanced to explore the influence of each parameter of photon energy to reach PDD optimum distribution and improve machine performance. The optimized parameters setting were electron gun current (Gun I ctrl):7.45, microwave frequency (LP ph.ctrl):16, bending system (Bending C):40, pulsing voltage (Chargerate):27.5 from this study result. This study got the best parameters combination of PDD and error is only 0.05%. In addition, the greatest contribution is bending system factor, the secondary contribution is electron gun current factor, the microwave frequency and pulsing voltage are secondary factor is based on the analysis of variance (ANOVA). Therefore, the results of study obtained to quantify the parameters of photon energy to help future medical linear accelerator operation and settings to reduce the dose error in radiation therapy.

Keywords: Linac, PDD, Taguchi Method