

Comparison of dose calculation algorithms model: convolution, superposition, and fast superposition in 3-D Conformal Radiotherapy (3D-CRT) treatment plan

ABSTRACT

The important task of radiotherapy is to make sure that the radiation dose to the target tumour is accurate as prescribed and the dose to the organ at risk is minimized. Therefore, the aim of this study is to compare and evaluate the efficiency of the dose calculation algorithms: namely convolution, superposition, and fast superposition which installed in Treatment Planning System (TPS) (CMS XiO, USA). In this study, we modified protocols described in IAEA Tecdoc-1583, where four typical treatment techniques such as single field, multiple field, wedge field, and multi-leaf collimated (MLC) field were analysed from the system. The measurement data for calculated dose and measured dose were taken from thorax CIRS anthropomorphic phantom. The assessment of algorithms was done by comparing the point dose calculated with the measured dose. The study shows that the superposition algorithm produced relative error less than $\pm 3\%$ which passed 100% of all reference points, whilst the convolution algorithm and fast superposition presented relative error more than $\pm 3\%$ which passed 82% and 91% of reference points, respectively. In conclusion, the evaluation of radiotherapy treatment plan shall take into account the type of dose calculation algorithm model in order to optimize radiotherapy treatment and ensure the radiation safety to the patient.