Original research article

Multiple-source models for electron beams of a medical linear accelerator using BEAMDP computer code

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Abstract

Aim

The aim of this work was to develop multiple-source models for electron beams of the NEPTUN 10PC medical linear accelerator using the BEAMDP computer code.

Background

One of the most accurate techniques of radiotherapy dose calculation is the Monte Carlo (MC) simulation of radiation transport, which requires detailed information of the beam in the form of a phase-space file. The computing time required to simulate the beam data and obtain phase-space files from a clinical accelerator is significant. Calculation of dose distributions using multiple-source models is an alternative method to phase-space data as direct input to the dose calculation system.

Materials and methods

Monte Carlo simulation of accelerator head was done in which a record was kept of the particle phase-space regarding the details of the particle history. Multiple-source models were built from the phase-space files of Monte Carlo simulations. These simplified beam models were used to generate Monte Carlo dose calculations and to compare those calculations with phase-space data for electron beams.

Results

Comparison of the measured and calculated dose distributions using the phase-space files and multiple-source models for three electron beam energies showed that the measured and calculated values match well each other throughout the curves.

Conclusion

It was found that dose distributions calculated using both the multiple-source models and the phase-space data agree within 1.3%, demonstrating that the models can be used for dosimetry research purposes and dose calculations in radiotherapy.
Keywords
Electron therapy; Multiple-source model; Treatment planning; Linac