AbstractID: 5662 Title: Application of the Strydom Analytical Model to the Remote Monitoring of Electron Beam Dosimetry Parameters by Thermoluminescent Dosimetry

Abstract

Purpose:
To provide a practical methodology and a reference percentage depth dose (PDD) data set for streamlining the Radiation Dosimetry Services (RDS) TLD verification of electron beam output and PDD.

Methods and Materials:
PDD data from 29 Siemens Primus and 19 Varian Clinac 21EX accelerators were retrieved from the databases of RDS and the Radiological Physics Center (RPC) and were simultaneously fitted to the nonlinear Strydom analytical model. The NLIN (SAS 9.1) procedure was used to fit the models. The PDD data sets used in the models were independently measured by many physicists from many institutions and verified by TLD and RPC onsite measurements. The resulting reference PDD data sets were incorporated into the RDS TLD analysis software for electron beam monitoring.

Results
The parameters of the model were estimated for 5 to 21 MeV electron beams for Siemens and Varian machines. Individual PDD data fell within ± 1.5 mm of the reference PDD data for all depths for all beams analyzed. The curves exhibited similar shapes and were found to agree within ± 1.0 mm at all depths when all the curves for a particular energy were made to coincide at the depth of 50%. The validated reference model's predictions shows good agreement with other published results.

Conclusions:
The shape of the PDD curves was found to depend only on beam energy, and was independent of model for newer machines. These results allowed RDS to streamline its process of evaluating TLD results for electron beams and to acquire additional information about an institution's PDD data to facilitate the identification of problems. The reference PDD data sets can serve as a resource to the medical physics community.

This work was supported by PHS grant CA 10953 awarded by the NCI, DHHS and Radiation Dosimetry Services.