Characterizes of Microdetectors in Electron Beam Dosimetry

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Presentations

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Purpose: Electron beam dosimetry requires high resolution data due to finite range that can be accomplished with small volume detectors. The small-field used in advance technologies in photon beam has created a market for microdetectors, however characteristics are significantly variable in photon beams and relatively unknown in electron beam that is investigated in this study.

Methods: Among nearly 2 dozen microdetectors that have been investigated in small fields of photon beam, two popular detectors (microDiamond 60019 (PTW)) and W1 plastic scintillator detector (Standard Imaging)) that are tissue equivalent and have very small sensitive volume are selected. Electron beams from Varian linear accelerators were used to investigate dose linearity dose rate dependence, energy dependence, depth dose and profiles in a reference condition in a water phantom. For W1 that has its own Supermax electrometer point by point measurements were performed. For microDiamond, a PTW-scanning tank was used for both scanning and point dose measurements.

Results: W1 detector showed excellent dose linearity (r^2 =1.0) from 5-500 MU either with variation of dose rate or beam energy. Similar findings were also observed for microdiamond with r^2=1.0. Percent variations in dose/MU for W1 and microDiamond were 0.2-1.1% and 0.4-1.2%, respectively among dose rate and beam energy. This variation was random for microDiamond, whereas it decreased with beam energy and dose rate for W1. The depth dose and profiles were within ±1 mm for both detectors. Both detectors did not show any energy dependence in electron beams.

Conclusion: Both microDiamond and W1 detectors provided superior characteristics of beam parameters in electron beam including dose, dose rate linearity and energy independence. Both can be used in electron beam except W1 require point by point measurements and microdiamond requires 1500 MU for initial quenching.