AbstractID: 12924 Title: Dose-Rate Constant Determination of the Xoft Axxent Electronic Brachytherapy Source Using Spectroscopic Methods

Purpose: To use spectroscopic methods to determine the dose-rate constant (DRC) of the Xoft Axxent® miniature x-ray source.

Method and Materials: Analytical methods have been used to determine the DRC of brachytherapy sources using spectroscopic methods. The method developed at Yale University (Med. Phys. 28, 86-96, 2001) was used with the Axxent® spectrum to calculate the spectroscopic DRC of the Axxent® source. While this method is useful its limitations are pronounced when applied to sources of considerable diameter, such as the Axxent® source. When source size increases the point- and line-source approximations are insufficient for buildup or attenuation calculations. This investigation modifies the original method to account for source diameter and calculates the DRC with measured and Monte Carlo (MC) generated spectra. The Axxent® spectrum was measured at 1 m in air with a low-energy germanium detector. The spectrum was corrected for detector response and air attenuation to obtain the emitted spectrum in vacuum.

Results: The measured spectrum agreed well with the MC generated spectrum. Slight differences in the spectra can be attributed to the energy resolution of the detector. The spectroscopic DRC calculated with the original method produced DRCs that were up to 23% low when compared to the MC calculated DRC. The modified method corrected the attenuation and buildup calculations to account for source diameter and produced DRC that were within 5% of the MC calculated DRC.

Conclusion: It was possible to measure and correct the photon spectrum of the Axxent® source. The original method for analytically determining the spectroscopic DRC works well for sources of very small diameter, but is insufficient when applied to sources of considerable diameter. The method must be modified to correct the attenuation and buildup determination in the monoenergetic DRC determination.

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