Purpose: To measure the dose-rate constant of the Xoft Axxent electronic brachytherapy source with an air-kerma calibrated ionization chamber.

Methods: An air-kerma calibrated chamber was used in TG-43 geometry (source and chamber in liquid water) to measure the dose rate of the Axxent source at several distances. The air-kerma strength was determined with the University of Wisconsin Attix free-air chamber. Since there is no national standard for absorbed dose to water at Axxent energies, this work followed the formalism of AAPM's TG-61 protocol to obtain dose to water from the air-kerma calibrated chamber. A Monte Carlo model of the chamber was created to calculate the necessary corrections to use the air-kerma calibrated chamber to obtain dose to water from chamber measurements. The chamber model was benchmarked with energy dependence simulations. The dose-rate constant was calculated from chamber measured dose rates and free-air chamber measured air-kerma strengths.

Results: The simulated energy dependence using the PinPoint chamber model showed agreement to within 4.2% of the measured values. The chamber-measured dose-rate constant was 4.6% higher than the Monte Carlo dose-rate constant and 13% higher than the TLD value, but the difference between the chamber-measured values and TLD-measured values decreased as the distance increased.

Conclusions: Using an accurate chamber model to calculate corrections allows an air-kerma calibrated chamber to be used for dose- rate measurements of a brachytherapy source. The chamber values agree with TLD values as distance increases implying that positioning uncertainties may cause greater discrepancies at shorter distances and the spectrum used for simulations may be more accurate at the larger distances. An air-kerma calibrated chamber was used to measure the dose-rate constant of the Axxent source provided corrections were calculated with an accurate chamber model.

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