Dosimetry of beta-ray ophthalmic applicators: comparison of different measurement methods

An international intercomparison of the dosimetry of three beta particle emitting ophthalmic applicators was performed, which involved measurements with radiochromic film, thermoluminescence dosimeters (TLDs), alanine pellets, plastic scintillators, an extrapolation ionization chamber, a small fixed-volume ionization chamber, a diode detector and a diamond detector. The sources studied were planar applicators of ⁹⁰Sr-⁹⁰Y and ¹⁰⁶Ru-¹⁰⁶Rh, and a concave applicator of ¹⁰⁶Ru-¹⁰⁶Rh. Comparisons were made of absolute dosimetry determined at 1 mm from the source surface in water or water-equivalent plastic, and relative dosimetry along and perpendicular to the source axes. The results of the intercomparison indicate that the various methods yield consistent absolute dosimetry along the source axis at depths of 5 mm or less, the agreement was 3% to 9% (one standard deviation) depending on the source and the depth. Crucial to the proper interpretation of the measurement results is an accurate knowledge of the detector geometry, i.e. sensitive volume and amount of insensitive covering material. From the results of these measurements, functions which describe the relative dose rate along and perpendicular to the source axes are suggested.