Purpose: To characterize a spatially sensitive large area ion chamber used for on-line entrance beam monitoring of radiotherapy.
Methods: A large area (26.5 ×26.5 cm2) ion chamber has been constructed using 2 mm thick aluminum plates, with the electrode separation varying linearly in one direction from 2 to 23 mm. The chamber has been characterized for (i) dosimetric performance and (ii) effect on the beam in terms of surface dose in the presence of immobilization devices. The ionization as a function of voltage at various dose rates was measured to determine the optimum operating voltage. The charge collection efficiencies and polarity effects also have been evaluated at various dose rates. The spatial sensitivity was determined by placing the chamber on the treatment couch at 100 cm source-to-detector distance and measuring the response due to small beamlets. The surface dose in the presence of an immobilization device was measured first, and then the chamber was introduced in the beam to evaluate the changes in the dose under various clinically relevant conditions.
Results: For a chamber operating voltage of 500 Volts the charge collection efficiency for 6 MV photon beams was found to be approximately 97%. The polarity effects were found to be negligible: -0.02% to 0.1% as the dose rate changes from 62 to 496 MU/min. The chamber response was found to be independent of dose rates. The spatial sensitivity relative to the chamber center varied from 0.45 to 1.37 for locations -10 cm to 10 cm in the gradient direction. The chamber did not significantly increase the surface dose in the presence of an immobilization device.
Conclusion: The operating conditions and the performance of the chamber were found to be suitable for use as an online beam monitor.