

Real Time Monitoring and Validation of HDR Treatment Delivery Using A Pinhole Collimator

To date, recording and verification of HDR brachytherapy treatments have relied solely on data provided by the machine console and observation of the spooling mechanism via a closed circuit TV. The aim of this study was to develop a method for monitoring and validating HDR treatments using images acquired with a pinhole collimator. Images of a Ir-192 source were recorded using a 0.5mm diameter high-energy pinhole collimator on screen film or an image intensifier. The spatial resolution of the pinhole image was studied by imaging two source positions separated by 1mm lateral displacement. Two distinct source images were observed on the film, separated by a gap of FWHM about 0.5mm. Similarly, a separation gap of FWHM about 2mm was observed when source positions were displaced axially by the commonly used 5mm step size. A dual pinhole system was also employed to acquire images of the source in an effort to reconstruct the source position in three-dimensions. Experimental results showed that reconstruction of the source position from the stereo-shifted images was accurate within better than 1 mm. Based on the reconstructed source coordinates and corresponding dwell times measured from image intensifier screen, the actual dose distribution can be computed. These results have confirmed that images of an Ir-192 source produced with a pinhole collimator and an image intensifier permit in-vivo monitoring of HDR brachytherapy treatments, while screen film images can be used to validate treatment delivery.