

Purpose:

The accurate completion of reliable quality assurance measurements of complex intensity-modulated and rotational radiotherapy treatments demands the use of a dosimetry system with both high resolution and minimal angular dependence. This study demonstrates the utility of Gafchromic EBT2 radiochromic dosimetry film for the quality assurance of complex radiotherapy treatments.

Methods:

This study establishes that the dose-response of EBT2 film has minimal angular and depth dependence and then demonstrates how the film can be used to perform quality assurance measurements for BrainLab stereotactic IMRT, Varian RapidArc and TomoTherapy treatments.

Results:

For all treatment plans, the proportion of dose points agreeing with the film measurements to within gamma(3%,3mm) was found to be above 95%, with all points agreeing within 5%, indicating that the treatments were delivered with an acceptable level of accuracy. The film images also provided additional information on low-level dose variations including: the location and extent of dose from inter-leaf leakage (for RapidArc); the location and extent of helical field junctioning effects, or threading (for TomoTherapy); and the existence of small regions of under-dosage from very small treatment segments (for stereotactic IMRT).

Conclusions:

The fact that these film measurements detected small-scale dosimetric effects that were not apparent in the dose planes exported from the treatment planning systems confirms both the value of high-resolution dosimetry and the importance of designing complex radiotherapy treatments with the maximum achievable level of target dose homogeneity.