

Purpose: The currently accepted techniques for monthly quality assurance of a CyberKnife system is inefficient with respect to time, uneconomical with respect to cost, and prone to setup error. We propose a new routine which reduces time allotment, cost, and susceptibility to error.

Methods: Our phantom includes three slabs of solid acrylic. The 0.5 mm-thick top slab provides buildup for radiochromic film which is sandwiched between the first and the 2 mm-thick second slab (containing a cavity drilled for insertion of a microchamber which intersects the beamline at the central axis. Between the second and third (3 mm-thick) slab are three fiducials which are used with stereoradiography for 6-axis phantom alignment. A plan is created which irradiates the phantom with all fixed and variable-diameter collimators used in our clinic. Each of these beams delivers 300 MU to the film, upon which beam widths can be verified. A set of 60-mm beams is directed to the center of phantom, coinciding with the location of the ion chamber (at 80 cm SAD). We irradiate the phantom three times with this beam (50, 100, and 150 MU), allowing verification of output calibration and dose-per-MU linearity.

Results: For three months, the new monthly QA routine was performed in parallel with the current routine. No notable deviations were noticeable with either method. The notable difference between the two routines was the reduction in setup and study time. From setup-to-analysis, the new routine took 45 minutes, while the former routine took three hours to complete. Additionally, comparable results were achieved using a single sheet of radiochromic film, as opposed to four sheets (which is required by the former routine).

Conclusions: We present a time-efficient and cost-effective method to perform monthly QA. The highly-automated nature of the aforementioned technique reduces setup time and can reduce setup error.