DOSE RESPONSE OF GAFCHROMIC XR-T FILM TO A NEW ELECTRONIC BRACHYTHERAPY SOURCE
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ABSTRACT

Purpose: To study the dose response characteristics of GAFCHROMIC XR-T film to a new electronic brachytherapy source based on a miniature x-ray tube.

METHODS

* Objective: To study the dose response characteristics of GAFCHROMIC XR-T film to a new electronic brachytherapy source based on a miniature x-ray source.
* Instrument: Xoft microTube Flexible X-ray Probe operated at 40 kVp and 100 μA.
* Films: GAFCHROMIC® XR-T films (Lot #30189-2 from International Specialty Products Corp.).
* Design: A series of calibration films (#0–10, about 2 cm x 2.5 cm) were irradiated at a distance of 11.5 mm from the X-ray tube axis in an RMI 457 solid water phantom. The irradiation times ranged from 0.2 to 12 minutes. Dose values were based on the dose rate generated from Monte Carlo calculations and verified by miniature ion chamber measurements. Dose values ranged from 1 to 60 Gy. The films were scanned using a CCD100 microdensitometer from PhotoScience Corp. (PeC-Green). GAFCHROMIC® XR-T film is a promising tool for new electronic brachytherapy dosimetry.

RESULTS

* The average optical density (OD) over a 1 x 1 mm area at the film center was obtained for each irradiated film.
* The background OD was determined to be the average OD over a 5 x 5 mm area for the background film kept in this set.
* The net OD (NOD) values were obtained by subtracting the background OD.
* Dose response curves (NOD vs. dose) were plotted for both red and green lights.

CONCLUSIONS

* Xoft has developed an electronic high dose rate brachytherapy device. The Xoft microTube Flexible X-ray Probe delivers tight, conformal doses of x-radiation to the inner surface of a body cavity such as an excised tumor bed. See Device Description and Device Specification for further details.
* The Xoft Treatment System does not require a heavily shielded environment, making treatment potentially available for women without access to a facility with an HDR afterloader. This treatment system potentially is available in less than 5 minutes.
* The Xoft microTube Treatment System allows for accelerated partial breast irradiation for patients with breast cancer or gynecologic cancer.

REFERENCES


SUMMARY

GAFCHROMIC® XR-T film was irradiated in an RMI 457 solid water phantom using an Xoft microTube Flexible X-ray Probe.

Calibration films were irradiated for 0.2 to 12 minutes with the x-ray probe operating at 40 kVp, 100 μA. Optical density was measured using a PhotoScience Corporation CCD100 microdensitometer with red (665 nm) and green (520 nm) lights.

The X-ray probe dose distribution was then evaluated using the calibration curve.

CONCLUSIONS

GAFCHROMIC® XR-T film is a promising tool with acceptable optical density range for new electronic brachytherapy dosimetry.

Initial measurements from one Xoft microTube x-ray probe indicate a spherically symmetrical dose distribution to within 11% over the angular range from 0 to ±150 degrees.

Figure 1. Side view

Figure 2. Top view

Figure 3. X-ray Source – Scattered to Side

Figure 4. X-ray Source – Scattered to Side

Figure 5. Image A of calibration films

Figure 6. Image B of calibration films

Figure 7. Calibration film data for 40 kVp

Figure 8. Calibration curve for XR-T film: Comparison of 40 kVp and 1MV

Figure 9. Film exposed for 8 minutes at a distance of 9 mm from the x-ray probe axis using 40 kVp and 100 μA

Figure 10. Isodose-rate curves projected into the plane through the x-ray probe axis

Net optical density was related to dose using miniature ionization chamber measurements and MCNP-4C Monte Carlo simulations. Data were compared with the same measurements obtained using an ion chamber.