AbstractID: 6452 Title: Peripheral brachytherapy, dosimetry, and image guidance using the AccuBoost system

Purpose: The Advance Radiation Therapy AccuBoost® system applies peripheral breast brachytherapy using combinations of stereotactic, parallel-opposed HDR ^{192}Ir beams under mammographic image guidance. Dosimetric characterization and commissioning for clinical use are presented.

Materials and Methods: The AccuBoost system delivers a conformal boost with the breast compressed to 3-7 cm thickness between two mammography paddles using 5, 6, or 7 cm diameter applicators. This compressed breast geometry was simulated using experimental techniques and Monte Carlo methods. Measurements were performed in a 30x30 cm^2 polystyrene phantom using a calibrated parallel-plate ionization chamber positioned at depths of 0-7 cm along the central axis, and with either radiochromic film (GafChromic EBT) or computed radiography phosphor plate (Kodak Hres) placed parallel and normal to the phantom:applicator plane. The MCNP5 radiation transport code was used to simulate the HDR ^{192}Ir source, AccuBoost applicator, and compressed breast, assuming cylindrical symmetry. Dose was calculated with 1 mm resolution versus depth and radius for all breast thickness and applicator diameter combinations. Dosimetric results were reduced to a spreadsheet-based lookup table for clinical implementation. Additional experiments were performed using a mammography system (GE Senographe 800T) and a CIRS breast phantom (model 051) containing radio-opaque markers for image evaluation and marker localization.

Results: Ionization chamber measurements and MC-derived dose falloff agreed within 2%. Film measurements and MC-derived relative dose profiles agreed within 6%. Skin/target dose ratio, for a dual axis exposure, varied from 0.5-1.1 over the wide range of applicator sizes and breast separations. Marker localization within 1 mm was achievable.

Conclusions: The AccuBoost system can apply a conformal boost dose to the breast in a stereotactic configuration. The clinical environment may be readily simulated and treatment plans may be verified as evidenced by good agreement amongst the three dose measurement techniques.

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