AbstractID: 11336 Title: The utility of Depth Dose Modulation (DDM) in electronic brachytherapy

Purpose: To illustrate the utility of Depth Dose Modulation (DDM) for Ir-192, Electronic Brachytherapy (EB) and EB_{DDM}.
Method and Materials: A numerical model was created for a miniature x-ray source equipped with an adjustable collimator that produces a fan-beam distribution. A general-purpose multi-particle transport code was used to calculate the dose distribution for multiple collimator gaps. A software program superimposed the collimated dose images at intervals to build an overall dose distribution for a simulated micro-stepping treatment. TG-43 data were input to the Nucletron PLATO treatment planning system. Treatment plans were generated for breast, endometrial and lung cases; doses to target volumes and normal tissues were compared for each of the planning sources.
Results: For the breast case, PTV coverage for Ir-192, EB and EB_{DDM} plans was 96, 100 and 94% with maximum skin doses of 100, 97 and 89% respectively. For the endometrial case, PTV coverage for the Ir-192, EB and EB_{DDM} plans was 99, 100 and 77% with maximum rectal doses of 140, 127 and 105% and bladder doses 115, 111 and 87% respectively. For equivalent prescription point doses in lung, with Ir-192, EB and EB_{DDM}, the maximum rib dose was 43, 30 and 34% while $V50_{Lung}$ was 11, 8 and 7% respectively.
Conclusions: With intracavity breast cases, DDM is a useful tool, reducing Ir-192 skin dose by up to 11% while maintaining adequate target coverage. For endometrial treatments, however, EB_{DDM} target coverage is inadequate; because of collimated source anisotropy, there is little dose deposition superiorly. To achieve full target coverage while maintaining significant normal tissue sparing, a treatment would require a combination of EB and EB_{DDM}. For lung, EB_{DDM} allows a two-fold reduction in $V50_{Lung}$.
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