

Comparison of an Anthropomorphic PRESAGE® Dosimeter and Radiochromic Film with a Commercial Radiation Treatment Planning System for Breast IMRT: A Feasibility Study

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Abstract : This work presents a comparison of an anthropomorphic PRESAGE® dosimeter and radiochromic film measurements with a commercial treatment planning system to determine the feasibility of PRESAGE® for 3D dosimetry in breast IMRT. An anthropomorphic PRESAGE® phantom was created in the shape of a breast phantom. A five-field IMRT plan was generated with a commercially available treatment planning system and delivered to the PRESAGE® phantom. The anthropomorphic PRESAGE® was scanned with the Duke midsized optical CT scanner (DMOS-RPC) and the OD distribution was converted to dose. Comparisons were performed between the dose distribution calculated with the Pinnacle3 treatment planning system, PRESAGE®, and EBT2 film measurements. DVHs, gamma maps, and line profiles were used to evaluate the agreement. Gamma map comparisons showed that Pinnacle3 agreed with PRESAGE® as greater than 95% of comparison points for the PTV passed a $\pm 3\%/\pm 3$ mm criterion when the outer 8 mm of phantom data were discluded. Edge artifacts were observed in the optical CT reconstruction, from the surface to approximately 8 mm depth. These artifacts resulted in dose differences between Pinnacle3 and PRESAGE® of up to 5% between the surface and a depth of 8 mm and decreased with increasing depth in the phantom. Line profile comparisons between all three independent measurements yielded a maximum difference of 2% within the central 80% of the field width. For the breast IMRT plan studied, the Pinnacle3 calculations agreed with PRESAGE® measurements to within the $\pm 3\%/\pm 3$ mm gamma criterion. This work demonstrates the feasibility of the PRESAGE® to be fashioned into anthropomorphic shape, and establishes the accuracy of Pinnacle3 for breast IMRT. Furthermore, these data have established the groundwork for future investigations into 3D dosimetry with more complex anthropomorphic phantoms.

Keywords : 3D dosimetry, PRESAGE®, IMRT, QA, EBT2 GAFCHROMIC film

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