

AbstractID: 5307 Title: Stereotactic Peripheral Brachytherapy and Image Guidance for the Breast

**Purpose:** Breast brachytherapy may be applied peripherally without piercing the skin as currently performed with interstitial and MammoSite applications. By virtue of being a protruding and deformable organ, the breast lends itself to peripheral brachytherapy by non-invasive applicators. A delivery system was made (Advanced Radiation Therapy, Billerica, MA) to implement this developmental treatment modality using real-time mammographic image guidance for stereotactic applicator positioning and CTV localization. In this design, therapeutic dose to the lumpectomy cavity is delivered by externally placing opposing plaque-like applicators at multiple orientations to provide conformity while not exceeding the skin toxicity threshold. An initial assessment of this system was performed to determine clinical feasibility. **Materials & Methods:** The applicator geometry comprises two curved plates which slightly compress the breast to minimize slab thickness irradiated by the parallel-opposed plaque. Within the applicator are a series of parallel catheters spaced 1 cm apart. For a thickness of 6 cm, the breast geometry and applicators were simulated using analytical (Pinnacle<sup>3</sup> treatment planning system) and Monte Carlo (MCNP v5) techniques. A breast phantom was used for CT-based treatment planning; however, standard-of-care for brachytherapy dosimetry algorithms assume an infinite water phantom. CTV ellipsoids ranged from 2x4x4 cm<sup>3</sup> to 3x6x6 cm<sup>3</sup>. Sources were positioned within the catheters to create a circular loading region (5 to 9 cm diam.) towards providing uniform CTV coverage. Dose homogeneity index (DHI) was determined for the skin. **Results & Discussion:** Average ratio of skin-to-tumor dose was < 0.9. Pinnacle and MCNP results indicated that DHI ~ unity for the CTVs studied. Dose to lungs, heart, and other critical organs was typically < 2%. These simulation results suggest that this technique may be an attractive APBI option. **Conflict of Interest Statement:** Advanced Radiation Therapy provided the applicator used in this study.