AbstractID: 8800 Title: Dosimetric Impacts on Tissue Homogeneity Corrections in Electronic Brachytherapy

Purpose: With increasing interests in utilizing electronic brachytherapy in accelerated partial breast irradiation, the lack of tissue inhomogeneity correction in the dose calculation draws clinical attentions. In this study, a Monte Carlo based dose evaluation was assessed in a human anatomy phantom to demonstrate these dosimetric impacts.

Method and Materials: The dosimetric characteristics of Xoft S700 Axxent^{TM} X–ray source (Xoft, Fremont,CA) were evaluated using EGS4 Monte Carlo code to verify the calculation method and source parameter accuracy. A virtual female human phantom utilizing all clinical parameters was used in the simulation. A balloon (diameter = 5 cm) was inserted in the right breast of the phantom. A 1 cm expanded volume from the balloon surface was designed to define as planning target volume (PTV). The prescribed dose was 3.4 Gy to 5 selected points (anterior, posterior, right lateral, superior and inferior) of the PTV. Dose, dose volume histograms of the PTV and normal tissues, isodose distributions in axial, sagittal and coronal planes crossing the center of the balloon were evaluated.

Results: Using measured 50 kVp source spectrum provided by Xoft Inc, the simulated radial dose function agrees well with the published data within 3%. The simulation shows clear dose uniformity with 90.6% of the prescription dose enclosing PTV. The two dimensional sagittal dose distributions show high skin and rib doses with reasonably acceptable doses to all other surrounding normal tissues. When accounted for the tissue heterogeneity, changes in the isodose distribution were observed.

Conclusions: This has been our first EGS4 Monte Carlo simulation study for the Xoft electronic brachytherapy system. Preliminary results demonstrate the dosimetric impact especially on the surrounding normal tissues, when tissue inhomogeneity consideration is taken into account.