AbstractID: 13467 Title: Investigation of water equivalency of PRESAGE dosimeters for electron beam radiotherapy

Purpose: To evaluate water equivalency of PRESAGE dosimeters for electron beam radiotherapy.

Method and Materials: In this work, three different PRESAGE polymer dosimeters were evaluated: the currently available PRESAGE as well as two with a new chemical formulation. Total mass stopping powers were calculated over the energy range 10keV-20MeV using the NIST ESTAR database for the three PRESAGE dosimeters and water. Monte Carlo modeling was used to determine the differences in depth doses between the PRESAGE dosimeters and water for a clinical 12MeV electron beam with a 10×10 cm^2 field size. The Monte Carlo calculations were performed using the EGSnrc/BEAMnrc package. The BEAMnrc user code was used to calculate the phase space file for the electron beam. The phase space file generated by BEAMnrc were then used to calculate depth dose curves for each of the three PRESAGE dosimeters and water using the DOSXYZnrc user code.

Results: Above 10MeV, total mass stopping power of the existing PRESAGE dosimeter has the highest differences with the value of water due to having the highest effective atomic number. For the calculated relative dose versus water equivalent depth, new PRESAGE dosimeters were in better agreement with the depth doses in water. For depths of less than 2cm water equivalent, the relative dose in water is up to 2% higher than the new PRESAGE dosimeters and 3% higher than the existing PRESAGE dosimeter. This can be attributed to higher collisional stopping power of water than the PRESAGE dosimeters due to its lower effective atomic number than the PRESAGE dosimeters. The maximum energy deposition in the three PRESAGE dosimeters is approximately in the same depth as water (2.7cm depth).

Conclusion: The PRESAGE dosimeters with the new chemical formulations are more water equivalent than the existing PRESAGE dosimeter and are suitable for dosimetry of electron beams.