AbstractID: 3109 Title: Monte Carlo Study of Delivered Dose as a Function of Applicator Material in HDR Brachytherapy.

Purpose:
Intracavitary HDR brachytherapy is used to treat gynecological tumors. Our system was first delivered with acrylic cylindrical applicators but these were sensitive to heat sterilization and were replaced with Delrin. We note the density of these materials increases from 1.19 g/cm^3 to 1.43 g/cm^3. We investigate the effect of the higher density applicators on the delivered dose distribution using Monte Carlo calculations.

Method and Materials:
Doses were calculated with the EGSnrc system, using DOSRZNRC. The cylinders, tandem tubes, transfer guide tubes, and the source wire were modeled as concentric open cylinders. For full backscatter, the phantom was modeled as water outside the cylinder to a minimum distance of 22 cm from the outer surface of the applicator. Primary and secondary emitted photons were followed down to a cutoff energy of 1 keV, and Compton scattered electrons were followed down to 10 keV. Total accumulated dose was scored at the surface of each cylinder and at 5 mm and 10 mm from the surface. All clinically available cylinders from 2 cm to 4 cm diameter and for both materials were modeled. Twelve and a half billion histories were run for each study.

Results:
Dose to the points of interest varied from 0.5% to 1.5% between the two materials with the dose at the points of interest being higher for acrylic cylinders than for Delrin. The differences are a function of cylinder size with the largest difference seen in the 4 cm diameter cylinders.

Conclusion:
The change in material from acrylic to Delrin results in systematically decreased dose to the patient. This decrease in dose is a function of cylinder size but is not large enough to be clinically significant. We recommend using the Delrin cylinders as they are more easily sterilized between uses.

Conflict of Interest (only if applicable):
None