Purpose:

To quantify the effect of 192Ir source attenuation due to titanium material used in manufacturing the new CT-compatible FSD device during treatment delivery.

Methods:

A typical cervical cancer treatment includes primary external beam followed by a course of HDR Intra-Cavitary brachytherapy using FSD applicator. A detailed geometry of the applicator obtained from the manufacturer is implemented using Monte Carlo (MC) simulation package MCNP5. The bending angles of tandem and colpostats are 150 and 1200 respectively. The source geometry is of the VariSource wire model VS2000. We assigned 8 dwell positions in the tandem and 4 dwell positions in each colpostat to calculate dose rate at reference points with and without titanium wall present in the simulation.

Results:

Based on the MC computation, the titanium tube reduced the overall dose to point A by ~1.5%, with contributions varying for each dwell position. We also compare MC results with BrachyVision treatment planning system calculations. The clinically used algorithm is based on AAPM report TG-43, which calculates the dose without inhomogeneity correction. The latest Varian release of the planning software BrachyVision-Acuros has the updated algorithm capable of inhomogeneity corrected dose calculation. For this study a treatment plan is created based on the exact coordinates of the MC model and used to calculate dose at reference points. The dose to reference point A with BrachyVision traditional algorithm is in excellent agreement with the homogeneous MC model result.

Conclusion: The attenuation due to Ti wall is ~1.5% at point A compared to ~5% using a non-CT compatible system. Comparative accuracy of the two treatment planning systems with MC, especially in their abilities to account for the source attenuation due to the applicator titanium walls will also be presented.

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No conflict