

DISTRIBUTIONS OF TISSUE VOLUME DOSE RESULTING FROM SMALL COMPARED TO LARGE DWELL SOURCE STEPPING IN THE RINGS AND TANDEMS OF GYNECOLOGICAL HDR BRACHYTHERAPY.

A Ring is ideal for cervix HDR brachytherapy but, unlike traditional Ovoids, is unshielded hence produces circular dose distributions needing optimization to lower normal tissue doses. Standard single-parameter optimization technique adjusts dwell times ΔT at fixed spacing, ΔS_0 . A double-parameter $[\Delta S, \Delta T]$ optimization is studied in terms of various types of dose-volume-histograms with gradient indices.

3D dose-volume matrices were computed for Rings different in degrees of tandem bend and diameters. ΔS was incremented 2.5-10mm and ΔT re-normalized to constant tumor doses. Comparative merits rested in natural [nDVH], cumulative [cDVH] and differential [δ DVH] histogram indices in cc/cGy.

Results showed smaller dwells produced superior dose-volume uniformity. Decreased ΔS lowered dose-volume gradients. At 2.5, 5.0 and 10.0mm ΔS , differential histogram ratios averaged 0.110, 0.166 and 0.20 cc/cGY, or cumulative values of 19, 21 and 24 cGy/cc. Natural histograms were shoulder-less at backgrounds rising from 9.5, 10.1, to 12 cc/cGy.

We conclude two-parameter optimization produces dose volume gradient generally flatter with shorter spacing ΔS . Clinically, it is desirable to sharpen the gradient falls around the bladder and rectum, yet maintain the gradient flat throughout the cervix volume. Dual parameter $[\Delta S \text{ plus } \Delta T]$ optimization may be a desirable HDR optimization technique, particularly for the Ring applicator.