

Evaluation of a Quantitative Dose Comparison Tool for IMRT and Conformal Therapy

A quantitative dose comparison tool has recently been introduced that provides a method for comparison between two dose distributions. The method uses a generalized dose-difference and distance-to-agreement metric (termed γ) to compare reference and evaluated distributions, which can be measurements-to-measurements, measurements-to-calculations, or calculations-to-calculations. Values of γ range from zero to infinity, and $\gamma > 1$ indicates that the distribution fails the specified comparison criteria. Tests of this technique are made using well-described test dose distribution geometries including a beam's-eye-view of a square open megavoltage field with the evaluated distribution modified to provide tests that include varying dosimetric and spatial offsets between the two distributions. Pseudorandom noise is added to both distributions to mimic the effect of experimental noise and evaluate the efficacy of the tool under these conditions. The sensitivity of the tool to variations in the evaluation criteria are also investigated. Because the technique provides a numerical value to the dose distribution comparison, the values are gathered into cumulative histograms for summary presentation. The addition of noise to the reference distribution has significantly larger impact than does noise added to the evaluated distribution, with large variations in γ with changes as small as 0.67 the size of the criteria. Adjustments in the criteria have significant impact as expected, with the influence of the criteria principally a function of the type of disagreement between the two distributions. This study provides guidelines for the use of this tool in clinical evaluations.