Minimizing the dosimetric effects of the rounded MLC leaf ends

The intensity profile near a rounded leaf end (RLE) is not a step function and has a penumbral distribution. The segmented nature of DMLC delivery implies that the transmission through the RLE is more serious than for static MLC treatment. The effect is usually approximated by a small offset δ (~0.5mm) applied to the leaf position. In other words, the added transmission is equivalent to enlarging the field size by 2δ. In practice δ is determined by visually examining a large number of film measurements with different offsets, which is both time consuming and inaccurate. We report an effective optimization algorithm for determining the optimal offset. Both experimental measurement and computer simulation data were used for the study. The experimental dose profiles were obtained using film and the calculated dose profiles were based on a geometric analysis of transmission through MLC. The calculation involved solving simultaneous equations for intercept points of the photon ray and the MLC surfaces. The dose profiles of two opposed leaves with the penumbra of the RLE were the input to the optimization software. The area difference between the idealized matching situation and the superposition of the two adjacent beams was used to guide the minimization to yield the best δ. The results obtained for different photon energies indicated the method provides a robust tool for clinical application of the DMLC delivery.