

When intensity-modulated beams are delivered with multileaf collimator (MLC), many factors can affect the dosimetric accuracy. This study evaluates the three main causes of dosimetric errors in the IMRT delivery with dynamic MLC: leaf and interleaf transmission, the tongue and groove leaf design, and the changes in output factor for different field segments. Leakage through the leaves and the gap between the leaves, as well as the underdose effects of the tongue and groove design were measured for all leaves under various leaf configurations and expressed in terms of dose/MU. For every point in the treatment field, the leaf configurations and the length of time that the point was under each configuration were calculated from the MLC prescription. The dosimetric effects of each of these configurations were then integrated to give the net effect for the entire delivery. The effect of output variation is calculated using a convolution algorithm based on an extra-focal model. The analysis was performed for several intensity distributions optimized for treating different sites. Comparisons were made between predictions and measurements. Based on the agreements between predictions and measurements, the model predicted the dosimetric effects from these three factors with acceptable accuracy. The results indicated that for the MLC used in our study, the leaf and interleaf transmission, the tongue and groove design and the output variations create significant dosimetric errors. They should be accounted for either in the planning process or in the process of converting desired beam intensities to leaf sequences.