Dynamic Multileaf-Diaphragm Sequencing with Adjacency Gap Constraints

Several methods of beam intensity modulation are currently available. One of the more versatile of these is the dynamic multileaf collimation in which fluence gradients are generated by independently controlled leaf velocity. A chief advantage of this method is the speed as well as the continuously conformal modulation. However, a certain design feature of a particular class of MLC's, namely the minimum gap requirement between opposing and adjacent leaves, has hampered implementation of the dynamic delivery concept. If neglected during conversion of the prescribed fluence to leaf sequence, the errors introduced by the gap constraints could lead to severe overdosage or underdosage. In order to overcome this problem we have developed a leaf sequencing algorithm which respects the gap constraints. In this algorithm the backup diaphragms parallel to the MLC are used to block the beam in place of leaves which may otherwise violate the minimum gap rules. In addition, the diaphragms perpendicular to the MLC are moved during delivery in order to define the horizontal field edges more accurately. The combined use of the orthogonal diaphragms can minimize the dose spillage around the field border. This feature is especially useful when the field shape is convex. The algorithm also permits a hybrid mode of delivery by inserting beam pauses to fine tune the modulation. With these techniques, it is possible to deliver difficult prescriptions such as those with zero regions or adjacent tracks with opposite slopes along the same vertical.