

Truly conformal therapy of the prostate and other internal organs requires localization of the tissues being treated on a per-treatment basis. An ultrasound imaging system for daily soft tissue localization (BAT) is currently being tested for use in image-guided clinical prostate treatments. One of the premises of the localization system is that the repositioning of patients will have negligible effects on the dosimetry of a pre-calculated treatment plan. Shifting the target with respect to the patient's external contour will cause small shifts in the SSDs of all treatment beams. This study evaluated conformal prostate plans for two delivery modalities: 1) the MIMiC multileaf collimator for dynamic arc IMRT; and 2) MLC delivery with a 7 fixed, intensity-modulated fields. Position shifts from 0.5 to 2.0 cm in anterior-posterior, superior-inferior, and left-right directions were modeled and evaluated.

For both MIMiC and MLC IMRT plans, 2.0 cm anterior-posterior shifts in the internal position of the prostate produced a change of about 5% in the mean dose to the prostate, if the position of the patient was adjusted to compensate for the prostate motion. Left-right and superior-inferior shifts in prostate position had negligible effects on dose. Uncorrected shifts in prostate position produced much larger changes in dose. For example, 2.0 cm anterior-posterior shifts caused mean dose variation greater than 20% for the prostate, with more than 70% of the prostate volume falling below the prescribed dose. Uncorrected anterior-posterior, superior-inferior and left-right shifts in prostate position produced equivalent effects.