This study analyzes the perturbation of dose in three dimensions when the patient is mispositioned during the delivery of intensity modulated radiotherapy. An IMRT plan of a head and neck tumor (using Corvus) is first calculated based upon a prescription which describes the desired dose to planning target volume and dose limits to adjacent critical structures. The output includes dose volume histograms and fluences describing the modulated beams. The patient anatomy is then shifted from 0-1cm along the three principle axes, and the intensity-modulated beams are applied to this geometry. The resulting dose distribution, evaluated at both specific points and through DVHs is analyzed. Inhomogeneities were turned on and the resulting dose perturbations also examined. The dose perturbation is clearly a function of the dose gradient and the location of the critical structures. In this study, 23 points associated with dose matrix values in the target, brainstem, optic nerves, and eyes were examined. For a 1 cm misplacement of the patient, perturbations of dose ranged from an underdose of 25% in the target and overdose of comparable magnitude for critical structures, normalized to the prescription isodose. A 5 mm positional variation results in an approximate 10% perturbation in dose. The results are interpreted within a theoretical framework.