

Purpose: First, to determine an average and maximum displacement of the shoulder relative to isocenter over the course of treatment. Second, to establish the dosimetric effect of shoulder displacements relative to correct isocenter alignment on the dose delivered to the target and the surrounding structures for head and neck cancer patients.

Methods: The frequency of shoulder shifts of various magnitudes relative to isocenter was assessed for 4 patients using image registration software. The location of the center of the right and left humeral head relative to isocenter (usually C2) was found daily from CT on rails scans, and was compared to the location of the humeral heads relative to isocenter on the initial simulation CT. Three Baseline head and neck IMRT and SmartArc plans were generated in Pinnacle based on simulation CTs. The CT datasets (external contour and boney structures) were then modified to represent shifts of the shoulder (relative to isocenter) between 3 mm and 15 mm in the SI, AP, and LR directions. The initial plans were recalculated on the image sets with shifted shoulders.

Results: On average, shoulder motion was 2-5 mm in each direction, although displacements of over 1 cm in the inferior and posterior directions occurred. Shoulder shifts induced perturbations in the dose distribution, although generally only for large shifts. Most substantially, superior shifts resulted in coverage loss of up to 152 cc for targets in the lower neck. Inferior shifts elevated the dose to the brachial plexus by 0.6-4.1 Gy. SmartArc plans showed similar loss of target coverage as IMRT plans.

Conclusions: The position of the shoulder can have an impact on target coverage and critical structure dose. Shoulder position may need to be considered for setup of head and neck patients depending on target location.