Purpose: To quantify the dosimetric accuracy of 6 degrees vs. 3 degrees of motion for patient positioning for cone-beam CT and HexaPOD Evo RT system (Elekta, Inc.) using the ArcCHECK (Sun Nuclear Corporation, software v.6.0) QA phantom.

Methods:

The average absolute values of our daily reported patient hexapod shift data were recorded and averaged for 18 patients. Using the CT scans of ArcCHECK, a QA plan was created in the Pinnacle (v.9.0) treatment planning system. By setting up ArcCHECK according to the QA plan and measuring the dose on Elekta Synergy, the baseline data was established. Next, an artificial shift was introduced in our phantom setup. A cone-beam CT scan of the phantom was obtained and images adjusted. The resulting translational and rotational shifts were recorded. The table was then moved according to the translational shifts only, and another measurement was taken. Next, using hexapod translational and rotational shifts, the table was moved in 6 degrees of motion, and the dose was re-measured.

Results:

For 18 IMRT patients, the average translational shifts were: x = 0.53 cm, y = 0.38 cm and z = 0.516 cm, and average rotational shifts were pitch = 0.979°, roll = 0.8° and yaw = 0.67°. The ArcCHECK phantom measured results were quantified using 3%, 3mm distance to agreement gamma analysis criteria when comparing measured to planned dose. Our measurements showed that an average 97.3% of the points agreed in plans with no shift. After the artificial shift was introduced, and cone-beam CT translational shifts were applied, 76.3% of points agreed. When both rotational and translational shifts were applied using Hexapod, an average of 93.4% of points agreed.

Conclusions: Using hexapod for imaging and patient positioning results in a significantly more accurate dose delivery as compared to using only CBCT, as shown by our ArcCHECK QA phantom results.

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none