AbstractID:8913 Title:Assessing Image Guided Radiation Therapy Targeting Accuracy: CoincidenceOfImagingSystem Isocenter With Treatment Machine Mechanical And Radiation Isocenters

Purpose: The purpose of this study is to introduce a method for quantifying the accuracy of linac and imaging system isocenters and demonstrate its use by measuring the targeting of two kilovoltage (kV) imaging systems, and one gantry mounted megavoltage Electronic Portal Imaging Device (EPID). One is the kV imaging system (OBI) integrated with the linear accelerator which supports radiographic and cone beam CT imaging. The other system is the BrainLab ExacTrac standalone fixed to the treatment room ceiling and floor.

Material and Methods: A cylindrical Lucite phantom was designed and fabricated to perform this study. The cylindrical phantom is 20cm in diameter and 20cm long. The phantom contains 13 radio-opaque fiducial markers. A 5mm spherical marker is positioned at the center of the cylinder. The phantom was imaged and the CT dataset were imported to two planning systems. Treatment beams were placed and both 3D data sets and isocenter information were transferred to the Linac delivery and imaging workstations. For each imaging system, phantom was initially positioned according to machine cross-hair. Then images were acquired and measured shifts were applied to precisely position the phantom. Then, Winston-Lutz test was performed for different gantry and collimator configuration. The radiation beam was collimated by a tray-mounted 30 mm diameter circular collimator.

Results: The radius of spherical volume in which all isocenter intersect or lie was measured. For EPID, OBI, CBCT, and ExacTrac, the radius is: 0.54 mm, 1.4mm, 1.7 mm and 1.46 mm respectively. From the Winston-Lutz analysis, the average isocenter deviation from all angles is 1.18 ± 0.28mm.

Conclusions: The error in mechanical, radiation and imaging isocenter is about one millimeter. Regardless what imaging system is used for patient setup, it is important to incorporate this systematic error in any planning margins.