

AbstractID: 13861 Title: Use Winston-Lutz Test to Check Cone Beam CT Isocenter Accuracy for Imaging Guided Intracranial Stereotactic Radiosurgery

Objectives: Cone beam CT (CBCT) opens the era of three dimensional (3D) imaging guided stereotactic radiosurgery (SRS). The CBCT isocenter accuracy is critical for imaging guided SRS guidance. This study analyzes the daily quality assurance (QA) results of using Winston-Lutz test to verify CBCT isocenter accuracy.

Methods: A Winston-Lutz phantom (Brainlab AG, Germany) is set up daily to align up with the isocenter (Novalis TX, Varian Medical Systems, Palo Alto, CA). After the isocenter is verified with Winston-Lutz ball-shot films, the couch position is recorded. The couch is then moved away from the isocenter. CBCT of the Winston-Lutz phantom is then acquired and matched to the planning CT to shift the target ball back to the isocenter. The displacement between the ball-shot film verified isocenter position and the CBCT determined isocenter position is calculated along anterior-posterior (AP), cranial-caudal (CC) and medial-lateral (ML) directions. This test is performed daily for SRS treatment. The results for the last half a year daily QA since we started this test are analyzed. The 3D vector of the isocenter displacement is also calculated.

Results: The mean values and standard deviations of the differences between the Winston-Lutz ball-shot film verified isocenter and the CBCT determined isocenter are 0.013 ± 0.044 cm, 0.078 ± 0.061 cm, and 0.016 ± 0.049 cm along AP, CC, and ML direction respectively. The histogram distribution of the difference along three orthogonal directions is shown in Figure 1. The histogram distribution of the 3D vector for the isocenter displacement is shown in Figure 2. The mean value and standard deviation of the 3D vector are 0.11 ± 0.04 cm.

Conclusion: Winston-Lutz test could be used for isocenter checks of both machine and kV imaging system. With proper QA tests, CBCT can provide accurate localization for intracranial SRS treatments.