AbstractID: 3166 Title: Accuracy and feasibility of cone beam computed tomography (CBCT) for stereotactic radiosurgery (SRS) setup

Purpose: To investigate the accuracy and feasibility of cone beam computed tomography (CBCT) for stereotactic radiosurgery (SRS) setup.

Method and Materials: A stereotactic BRW frame was attached to a Rando head phantom with imbedded radio-opaque markers (1mm in diameter) simulating the target locations. The head phantom with a CT localizer was first simulated for radiosurgery planning on a conventional CT scanner and then scanned on a treatment machine using CBCT. The differences between the conventional and CBCT localizations of the target positions were computed using a radiosurgery planning software. The translational corrections for target positions were calculated as the differences between the CBCT coordinates of the machine isocenter and the planned isocenters, which were the planned BRW coordinates from the conventional CT scan multiplied by the transformation matrix between the BRW and CBCT coordinate systems on the CBCT scan. The setup accuracy of CBCT was assessed from the analysis of orthogonal projection images for each radio-opaque target at the machine isocenter.

Results: All nine fiducial markers of BRW localizer were successfully identified on all but one slice of the CBCT scan. The average localization difference between the conventional CT and CBCT BRW target coordinates was 0.28mm (SD 0.10mm). The mean distance error for all the radio-opaque targets localized using the CBCT and orthogonal projection images was 1.28mm (SD 0.61 mm). The major contributing factor to this cumulative setup error was the uncertainty in the superior-inferior direction due to the 2mm slice thickness in conventional CT.

Conclusion: The CBCT image guidance can be used to setup SRS patients within accuracy comparable to the current SRS standard using an external fiducial system. The technique described here can serve as a gold standard for evaluating the accuracy of alternative immobilization and setup devices for SRS.