AbstractID: 6519 Title: A feasibility study of image-guided non-invasive single-fraction stereotactic radiosurgery using the 2D2D match of an on-board imaging system

Purpose: To investigate the feasibility of image-guided non-invasive single-fraction stereotactic radiosurgery (SRS) using the 2D2D match of a kilo-voltage on-board imager (kVOBI).

Method and Materials: An institutional-approved prospective protocol was developed to evaluate the accuracy of frameless SRS over our current invasive system. Each participating patient was immobilized with a thermoplastic mask covering the face and shoulders. Anterior-posterior and lateral digitally reconstructed radiographs (DRRs) were generated based on the treatment isocenter identified on the planning CT scan. The patient was then transferred to the treatment room and setup by manually aligning an orthogonal pair of kVOBI projection images with the corresponding DRRs. The patient remained in the treatment position for 20 minutes to simulate a mock SRS treatment. Two cone-beam CT (CBCT) scans, acquired at the beginning and end of the procedure, were fused with the simulation CT scan to determine the setup accuracy and cumulative intra-fraction movement. For comparison, the setup accuracy was also measured for the same patient in an invasive SRS frame.

Results: Three patients were successfully recruited and studied to date. The setup accuracy (distance between the center of the first CBCT scan and planning isocenter) was 2.25±0.67 mm (mean ± one standard deviation). The cumulative intra-fractional movement was 1.91±0.30 mm, mainly in the superior-inferior direction (1.79±0.45 mm). The total setup error at the end of treatment (the second CBCT scan) was 3.89±0.09 mm. The setup accuracy of invasive SRS frame was superior (1.63±1.39 mm) in comparison to the mask system.

Conclusion: The setup accuracy of two-dimensional kVOBI was insufficient for single-fraction SRS. Volumetric CBCT scanning should be used instead for frameless SRS setup. The observed cumulative intra-fractional was significant for the mask system and should be monitored and corrected using a realtime position feedback device.