AbstractID: 11380 Title: Evaluation of positioning for head and neck patients using 2D and 3D image guidance

Purpose: To determine and compare reduction of setup error by two-dimensional (2D) and three-dimensional (3D) image guidance for radiation therapy of head and neck cancer (H&N) patients immobilized by customized masks.

Methods and materials: Ten patients, immobilized with custom thermoplastic masks, received weekly imaging sessions throughout treatment. A patient was first set up by matching lasers to surface marks (conventional) and then translationally corrected using manual registration of orthogonal kilovoltage radiographs with DRRs (2D/2D). A cone-beam CT (CBCT) was acquired and manually registered to the simulation CT to determine further translational corrections (3D/3D-manual). The registration structures were in-field bony anatomy. A post-treatment CBCT was acquired to assess intra-fraction motion. We retrospectively evaluated the conventional, 2D/2D and 3D/3D-manual setup with an in-house automatic 3D/3D rigid-body registration algorithm using translations-only (3 degrees of freedom, DOF) and translations plus rotations (6 DOF). 56 treatment sessions (2-7 per patient) were analyzed.

Results: Averaged over all sessions, 2D/2D registration led to translational corrections from conventional setup of magnitude 4±2 mm, range (0-8 mm). The addition of 3D/3D-manual registration resulted in only small incremental adjustment (1±2 mm). For nine patients, the automatic 3 DOF registration agreed well with the final pre-treatment position (overall 2±1 mm , range 1-7 mm). One patient showed significant differences (8±3 mm, range 4-12 mm); a loose-fitting mask and resulting anatomical deformation were noted. However, the impact on dose even for this patient was minimal. For all patients, rotations determined by the 6 DOF registration of in-field bony anatomy were < 4° around any axis. Intra-fraction motion was < 2 mm and < 2° for all sessions.

Conclusions: Manual 2D/2D registration of in-field bony anatomy reduces positioning errors for mask-immobilized H&N patients in most cases, and is easily implemented. 3D registration adds little improvement.