AbstractID: 10132 Title: Offline analysis of the frequency and accuracy of OBI kV/MV imaging for head-and-neck and brain IMRT using rigid and deformable image registration techniques

Purpose: To assess the necessary imaging frequency and the accuracy of head-and-neck and brain IMRT patient setup/target-localization based on OBI kV/MV imaging. **Methods and Materials:** KV or MV orthogonal images were routinely acquired during setup for 12 selected head-neck cancer and brain tumor patients for IMRT treatments. Initial setup offsets were determined online through an interactive image registration procedure and corrected by couch-shifts before commencing each treatment. These images and shifts were retrospectively analyzed using a rigid-body image registration algorithm based on normalized mutual information (NMI). In addition, residual offsets of the projected regions of target and OAR (organ at risk), including CTV, brainstem and the 5mm-expanded spinal cord, were analyzed in a deformable image registration analysis based on a B-Spline representation of head-neck anatomy in the anterior-posterior and lateral views. **Results:** 1). Among all imaged fractions analyzed by rigid-body registration, ~45% reported larger-than-3mm vector offsets, ~21% showed larger-than-5mm vector offsets, all detected position offsets were corrected prior to delivery via couch shifts; 2). Deformable registration showed that residual offsets for regions of projected target and OAR volumes in lateral views are in general larger than those in the AP views; For target volumes, ~10% of the lateral images showed larger than 5 mm mean offsets and ~60% showed larger than 3 mm, while less than 10% of the AP images showed larger than 3 mm mean offsets. **Conclusions:** For head-neck and brain IMRT cases involving OAR volumes less than ~5 mm away from PTV, daily kV or MV imaging is essential for avoiding under-dose to target volumes and increased-dose to OAR volumes. Deformable registration showed that PTV margins of 3~5 mm, as often used for head-neck and brain IMRT, are marginally adequate to account for the residual offsets which can not be fully corrected by couch shifts alone.