AbstractID: 8131 Title: Image-Guided Adaptive Radiation Therapy for Head and Neck Cancer Using Adaptive Planning CT Images

Purpose: The purpose of this study is to develop a practical methodology for near real-time patient positioning and dosimetric re-planning using CBCT. This study reports our investigation into the potential of using adaptive planning CT (ApCT) which combines the planning CT (pCT) and CBCT for dosimetric evaluation in the radiotherapy of head and neck cancers. **Method and Materials:** A Varian Clinac-iX linear accelerator with the on-board imager (OBI) was used to obtain CBCT images. The CBCT and pCT images of head and neck patients were registered weekly to generate ApCT images using our in-house image registration software. The registration similarity measure was intensity based “mutual information”, operated in the “neighborhood” region. The search was optimized using the “downhill simplex” algorithm. The registration registered internal anatomies on the pCT and CBCT, while the external contours were extracted from the CBCT and superimposed onto the pCT to form the ApCT. Dose distributions and dose-volume histograms were re-calculated based on ApCT. Depending on the results, a decision could be made whether re-optimization was necessary - if needed it was performed using the ApCT. **Results:** It was found that the localized rigid image registration was satisfactory since most structures in head and neck patients were quite rigid. The doses to the respective PTVs and critical structures were compared between the initial treatment plan and the adaptive plans based on ApCT images. For those that failed to meet clinical criteria, the IMRT beams were re-optimized using the ApCT images. **Conclusions:** Re-planning with ApCT images was accurate, time efficient, and cost effective. The actual dose delivered could be accurately assessed based on the ApCT, which eliminates the potential dosimetric errors resulting from the uncertainty in inhomogeneity correction in CBCT-based planning.