AbstractID: 5075 Title: Accuracy testing of deformable registration using dosimetric end-points

Purpose: To develop a dose-based evaluation method to assess deformable image registration accuracy

Method and Materials: An algorithm developed for deformable registration of MVCT to kVCT images was evaluated. The algorithm allows the generation of automatic contours on MVCT images by transferring the kVCT contours using the deformation map. The automatically generated MVCT contours can thus be used to test the deformation algorithm by comparing these contours with manual contours.
Instead of a geographic contour comparison, dosimetric endpoints were evaluated after the dose distribution was calculated in the MVCT images. Three dosimetric endpoints (D_{max}, D_{mean}, and Dose to the hottest 2 cc ($D_{max\ (2cc)}$) were compared for spinal cord contours. The evaluation of geometric end-points is directly related to the clinical information that needs to be evaluated if daily images are used for adaptive radiation therapy. A total of 93 daily megavoltage CT (MVCT) images from three patients treated for cancers in the head and neck region were evaluated.

Results: Averaged over all images the calculated D_{max} differed between the automatic and manual contours by 1.1 % with a standard deviation of 3.5 %. The respective values for D_{mean} and $D_{max(2cc)}$ are 0.1 ± 2.5 % and 1.8 ± 2.4 %. Maximum deviations between the dosimetric endpoints were 12 % for D_{max}, 8% for D_{mean}, and 13 % for $D_{max(2cc)}$.

Conclusions: Using deformable image registration, dosimetric end-points can be generated from automatic contours in the spinal cord region that differ from manual contours by 1-2 % on average with a standard deviation of 2.5 to 3.5 %. In the spinal cord region the developed deformable image registration appears to provide sufficient accuracy to support clinical decisions.

Conflict of interest: Research supported by the vendor that is commercializing the algorithm. Several co-authors are vendor employees.