AbstractID: 10876 Title: A new method to calculate the dose distribution from an isocenter shift without recalculating dose distribution to evaluate plan with geometric uncertainties

Purpose: To investigate the validity of the shift invariance method in assessing target coverage considering geometric uncertainties for shallow tumor cases and present the contour correction method of determining the dose distribution from an isocenter shift without recalculating the dose distribution.

Method and Materials: The proposed method separates the effect of an isocenter shift on the dose distribution into two parts: along and perpendicular to the beam direction. An isocenter shift in the beam direction results in a change of source surface distance and of irradiated area. In that case, an inverse square correction is applied to the static dose distribution. An isocenter shift in the direction perpendicular to the beam direction results in a shift of the dose distribution, assuming that the surface curvature seen by the beam does not change. The patient-beam interface correction method is applied to the shifted dose distribution to take into account patient-beam interface changes. The dose volume population histograms (DVPHs), which incorporate geometric uncertainties into the DVH display, using the contour correction method was calculated and compared to those from the shift invariance and the recalculation methods.

Results: For the selected case, the target minimum doses (to 99% of the CTV) with a 90% confidence level are 75%, 102% and 102% using the shift invariance, contour correction and recalculation methods. The DVPH computational time are about one week, 60-120s and 10-30 minutes using the recalculation, shift invariance and contour correction methods respectively.

Conclusion: The shift invariance method is invalid for use in evaluating the target coverage in shallow tumor cases where the PTV extends into the build up region. The suggested contour correction method provides a quick means to assess the target coverage considering geometric uncertainties without a full recalculation of the dose distribution for those cases.