AbstractID: 12864 Title: Variable Planning Margin Approach to Account for Locoregional Variations of Setup Uncertainties

Purpose: To implement variable treatment planning margins to account for regional variations of setup uncertainties in Head-and-Neck cancer radiotherapy.

Method and Materials: Five bony landmarks (C2, mandible, C5, caudal C7, jugular notch) were identified from previous studies. At each point on the CTV, a variable margin was calculated as the weighted average of margins at the landmark points, with the weight determined by a Gaussian falloff function of the distance between the current location and landmark point. Ten CT images of a Head-and-Neck cancer patient were used to test this variable margin strategy, in comparison with the standard global margin expansion method. We examined the overlapping of CTV and PTV in these 10 actual setup positions to evaluate the effectiveness of the design strategy.

Results: For the variable margin approach using a margin of 2.5mm at the reference landmark C2, an averaged 99.20% of CTV is enclosed within the PTV, while a constant 2.5mm margin expansion results to 97.88% coverage. With reference margin reduced to 2.0mm, the variable margin approach has an averaged coverage of 97.84%, similar to that of constant 2.5mm margin expansion; however, it has a smaller PTV volume than the constant 2.5mm margin design. Paired t-test on samples from 10 treatment fractions shows no significant difference on CTV coverage between variable 2.0mm margin and constant 2.5 margin approaches (p=0.054), but the non-overlapped PTV portion is significantly smaller for the variable 2.0mm margin approach than the constant 2.5mm margin approach (p<0.0001). Our result also shows a better CTV coverage when using the variable margin approach in the lower neck area where a larger setup error normally occurs.

Conclusion: We implemented a variable margin approach to account for regional variations of setup errors for Head-and-Neck cancer radiotherapy, and demonstrated its superiority over the global constant margin expansion approach.