Purpose: To determine if different ways in PTV delineation at an air cavity interface yield differences in overall plan quality and treatment efficiency

Methods: Three different PTVs were used for treating a patient whose CTV surrounded a large air cavity created by a resected hard palate. The CTV lined the surface of the air cavity while PTV1 included the entire air cavity, PTV2 extended 4mm from the surface of the cavity into air, and PTV3 was reduced 4mm within the surface of the cavity. Tomotherapy plans were generated for all three PTVs. During each planning, all constraints to target and normal structures were kept constant along with the number of optimizations. Same planning process was repeated on a head and neck digital phantom with mock target, normal structures and cavity.

Results: Three treatment planning approaches showed no significantly different target coverage in terms of minimum or maximum dose to their respective PTVs. All plans attained 95% coverage of the CTV and PTV by 100% of the prescription. The conformity index (CI) of the plans delivered to PTV1, PTV2, and PTV3 were 1.09, 1.11, and 1.18, respectively. The skin, optic nerves, brainstem and spinal cord all received similar maximum dose to their respective volumes for each plan within 1Gy. The monitor units required for each treatment plan were all within 6% of one another with PTV1 having the highest. For head and neck phantom, the CIs of three plans were 1.05, 1.21, and 1.18, respectively. The coverage of the phantom CTV and sparing of normal structures were nearly equivalent. The total treatment times were identical.

Conclusions: Tomotherapy planning is able to deliver dose to a head and neck PTV containing a large air cavity without compromising target coverage, sparing of normal tissues, or delivery time.