

## INTRODUCTION

Various open access head and neck knowledge-based planning (KBP) models are available but have varying performance. This study evaluates a new open access RapidPlan (RP) model, called HN-SIB-BPI, which was created using a previous best performing model as a foundation.

## AIM

To increase conformality and further reduce dose to OARs, including parotid glands, with the quantification of improvement evaluated with a dosimetric scorecard. The model's performance was tested in a clinic in India and compared to existing plans.

## METHOD

- 18 head and neck cancer (HNC) patients (9 oropharynx, 5 oral cavity, 1 larynx and 3 hypopharynx) with PTVs overlapping or abutting bilateral parotid glands previously treated with volumetric modulated arc therapy (VMAT), were selected to be replanned with HN-SIB-BPI.
- These new treatment plans were created for both C arm (TrueBeam™ [TB]) and O gantry (Halcyon™) based delivery systems utilizing the same four arc arrangement specified in HN-SIB-BPI model documentation.
- HN-SIB-BPI C arm and O gantry plans were compared against TrueBeam Manual Comparator Plans (TB-MCPs). Statistical significance for dose comparisons were performed using Student's t-tests.

## RESULTS/DISCUSSIONS

- Both C arm and O gantry plans exhibited a significant mean dose reduction in the **left and right parotid glands** of when compared to TB-MCP
- Both C arm and O gantry plans demonstrated reduced doses to the brainstem and spinal cord as well
- However, C arm and O gantry plans showed an increased mean dose to lips compared to TB-MCP
- PTV coverage was generally similar between C arm, O gantry, and TB-MCP

Deasy et al. reported that gland function reduction gradually increases at radiation dose of 20-40 Gy, with dramatic reductions at >40 Gy.<sup>1</sup> Lou et al reported that among 21 patients, the planning dose  $D_{mean}$  was 30.6 Gy for patients with xerostomia and 26.3 Gy for patients without xerostomia.<sup>2</sup> In addition, several studies suggest mean parotid dose should be kept below 26 Gy for adequate preservation of salivary gland function, but above 20 Gy due increased risk of HNC recurrence.<sup>3-5</sup> For HN-SIB-BPI, the mean dose to the left and right parotid glands were in the 23-24 Gy range, with similar or better PTV coverage.

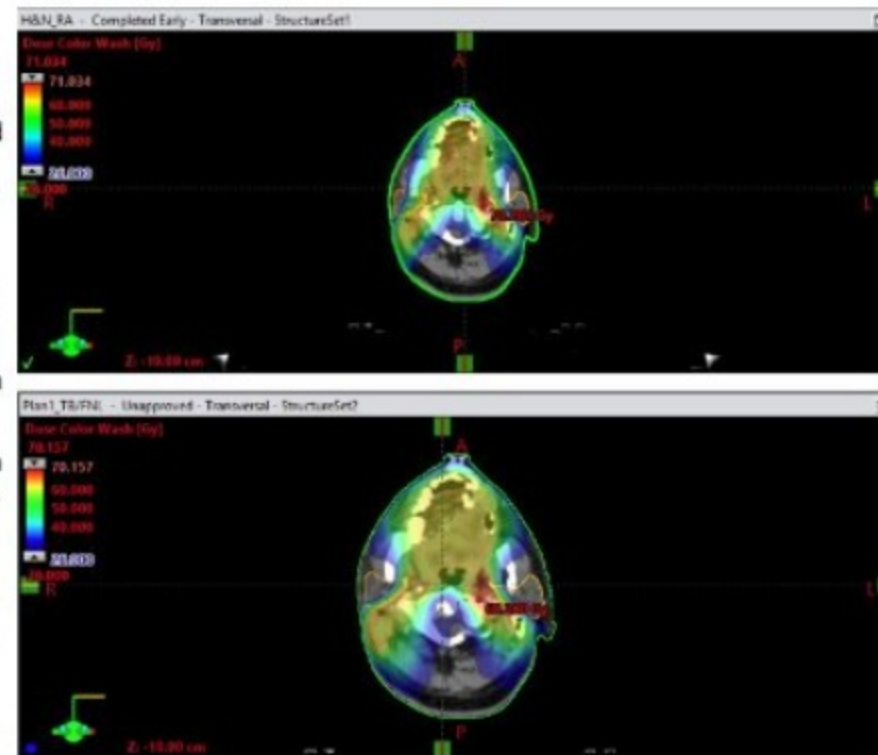


Figure 1A (Above) and 1B (Below). An example case planned with TB-MCP (standard, 1A) and HN-SIB-BPI model delivered on C arm system (1B), with 26 Gy isodose line showing significant parotid sparing in the HN-SIB-BPI model compared to the TB-MCP model.

	TB-MCP	C arm	O gantry	C arm vs TB-MCP		O gantry vs TB-MCP	
				Mean difference	p value	Mean difference	p value
PTV66 (V <sub>90</sub> >97%)	87.07±0.98	97.10±2.90	95.27±2.51	9.13±7.98	0.10	8.30±7.18	0.10
PTV66 (V <sub>90</sub> >95%)	89.01±0.47	99.79±0.36	99.90±0.36	0.19±0.73	0.65	0.36±0.51	0.25
PTV70 (V <sub>90</sub> >97%)	92.05±0.39	94.77±2.13	93.52±4.49	2.54±6.17	0.40	1.30±1.91	0.35
PTV70 (V <sub>90</sub> >95%)	93.32±0.67	99.63±0.49	99.78±0.17	0.32±0.95	0.62	0.46±0.62	0.33
PTV94 (V <sub>90</sub> >97%)	91.09±4.03	97.29±1.32	95.71±2.14	6.20±6.15	0.29	5.62±6.97	0.49
PTV94 (V <sub>90</sub> >95%)	95.23±0.82	99.34±0.42	99.49±0.13	1.11±1.24	0.43	1.26±0.95	0.31
PTV90 (V <sub>90</sub> >97%)	89.20±4.67	95.55±1.38	95.90±1.81	6.35±6.00	0.03	6.70±4.80	0.01
PTV90 (V <sub>90</sub> >95%)	97.05±2.03	99.65±0.39	99.72±0.33	1.99±2.02	0.04	2.00±2.02	0.04
PTV94 (V <sub>90</sub> >97%)	89.37±3.75	97.23±0.95	95.39±1.45	7.86±3.55	0.01	5.99±3.93	0.03
Brainstem (D <sub>max</sub> >54Gy)	30.25±10.59	24.27±10.67	24.01±10.85	-5.98±6.64	<0.01	-6.24±6.42	<0.01
Larynx (D <sub>max</sub> >60Gy)	40.05±16.06	36.32±17.35	38.32±16.63	-4.22±4.53	<0.01	-2.21±5.42	0.12
Lips (D <sub>max</sub> >20Gy)	27.12±12.09	29.77±12.36	28.32±12.01	1.65±2.76	0.60	1.20±2.22	0.04
L Parotid (D <sub>mean</sub> >20Gy)	26.90±6.96	23.33±6.91	24.10±7.31	-3.57±2.65	<0.01	-2.80±2.94	<0.01
R Parotid (D <sub>mean</sub> >20Gy)	24.89±6.98	23.03±10.59	23.28±10.12	-1.86±2.13	0.01	-1.41±2.20	0.01
Spinal Cord (D <sub>max</sub> >50Gy)	33.15±3.50	28.32±3.58	27.59±3.02	-4.83±4.67	<0.01	-5.56±3.75	<0.01
Total MU	696.18±103.61	793.56±75.89	758.93±69.61	97.38±147.50	0.04	72.75±125.69	0.04

Table 1. Dosimetric comparison between TB-MCP (standard) and HN-SIB-BPI model delivered on C arm and O gantry delivery systems.

## DISCUSSIONS/CONCLUSIONS

- The HN-SIB-BPI open access KBP model was validated in our local Indian patient population, demonstrating significant reduction in parotid glands dose while maintaining similar target volume coverage
- As a result of this study, HN-SIB-BPI is now the default model used in our clinics for the treatment of HNC. Readers may download and find more information about the model used in this study at: <https://medicalaffairs.varian.com/hn-sib-bpi-rapidplan-vmat2>

## REFERENCES

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