

# Dosimetric Changes of the Parotid as a Result of Head and Neck Adaptive Radiotherapy

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## INTRODUCTION

One of the primary goals of HN adaptive radiotherapy is to reduce the dose that normal tissues are receiving that may be caused by changes in anatomy. The exact time when to adapt a plan to have the maximum impact while maintaining clinical workflow remains a point of debate. In this study we focused on one of the main organs that are affected by toxicity in the oral cavity, the parotids, and investigate the effect that changes in the anatomical relationship between the parotids and the PTV have on the dosimetric impact of adaptation.

## AIM

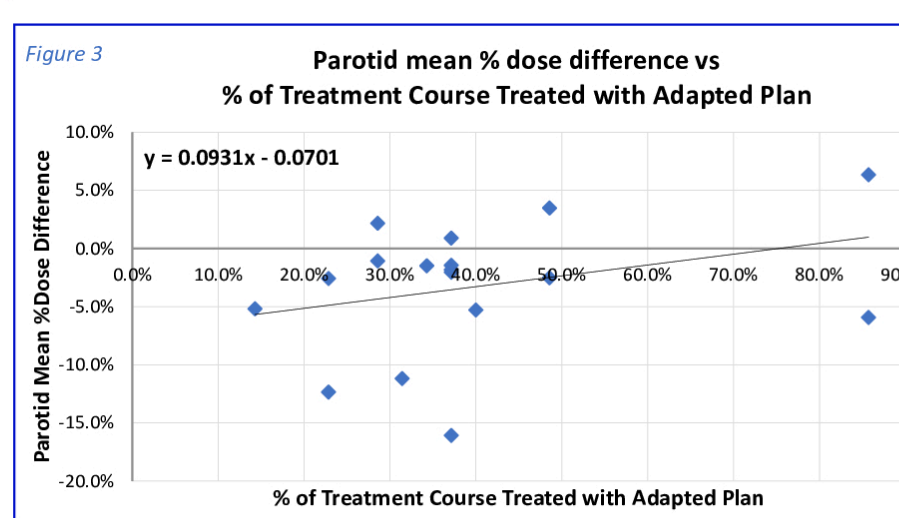
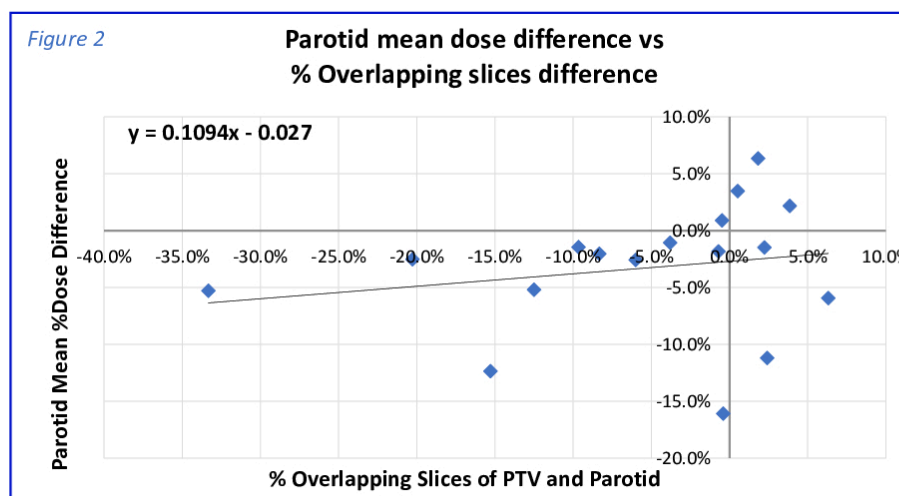
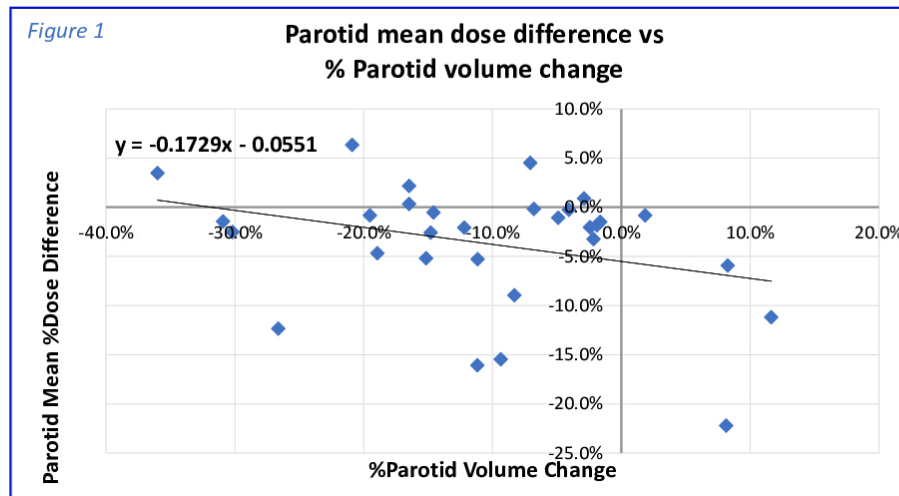
To compare the mean dose to the parotids in head and neck adapted plans versus completing the course un-adapted, and to correlate dose changes with anatomical changes in this region.

## METHOD

- 15 patients with oropharynx cancer received adaptive radiotherapy.
  - Prescription:** Most patients received 30Gy in 15 fractions to the low-risk region with a sequential boost to 70Gy in 20 fractions to the gross disease.
  - Initial Planning:** All phases planned using the initial CT
  - Adaptive Replanning:** The decision to replan was made based on weekly MR assessment of nodal targets and plans were adapted between fraction 5 and 30.
- The dosimetric data of the planning target volume (PTV) and mean dose to parotids were compared between the adapted course and original course plans.
- Anatomical distances and overlap between the PTV and the parotids were computed and compared with the dosimetric changes

## RESULTS

- The gross disease PTV coverage for both the original and adapted plan remained the same.
- Parotid volume change**
  - The parotid volume changed by -10.6% on average [-36%-11.6%], and the mean dose to the parotids changed by -3.7% [-22.2%-6.3%] in the adapted plan.
  - The largest correlation (-0.32, slope -0.17) between anatomy and mean dose to the parotid was observed in the parotid volume change.
  - Figure 1** shows the parotid volume change as a function of the change in the mean parotid dose. The negative correlation indicates that the larger the reduction in the parotid volume the smaller the dosimetric sparing of the parotids.
- Change in overlap between parotid and PTV**
  - Figure 2** shows parotid dose difference as a function of the change in the number of slices on which the PTV and parotids overlap. The small positive correlation indicates that the less the parotid and PTV overlap the larger the dosimetric benefit on the parotid.
  - The degree of overlap between parotids and PTV also contributes to parotid sparing. Our results suggest that as the PTV shrinks away from the parotid, the parotid mean dose reduces.
- Time of plan adaptation**
  - There was also a positive correlation (0.31, slope 0.09) between the fraction at which the plan was adapted and the mean dose of the parotids as seen in **Figure 3**.
  - This indicates that the earlier the plan was adapted due to changes in anatomy, the more dose difference was seen in the parotids.



Change in parotid gland characteristics and its relationship with the PTV seen between initial and adapted Planning

Parotid #	Absolute Volume (cc)	% Volume	3D Overlap with PTV (%)	Mean Distance from PTV (mm)	Overlapping Slices with PTV (%)	Difference in Parotid Mean Dose - Adapt/not adapt (%)
1	-13.9	-30.2%	-5.7	9.3	-20.3%	-2.5%
2	-8.2	-11.2%	-2.4	0.0	-0.4%	-16.1%
3	-6.9	-30.9%	-2.2	2.1	-9.7%	-1.5%
4	-6.7	-20.9%	0.7	0.0	1.8%	6.3%
5	-7.4	-15.2%	-0.7	-2.5	-12.5%	-5.2%
6	-3.4	-14.8%	-2.5	2.1	-6.0%	-2.6%
7	-0.8	-1.9%	-0.6	0.0	-0.7%	-1.8%
8	-1.3	-2.4%	-0.1	3.0	-8.3%	-2.0%
9	4.0	8.3%	4.0	-0.7	6.3%	-5.9%
10	-17.0	-36.0%	-4.7	5.2	0.5%	3.5%
11	3.0	11.6%	-0.1	0.2	2.4%	-11.2%
12	-2.0	-4.9%	0.1	-2.9	-3.8%	-1.1%
13	-7.7	-11.2%	-1.4	13.8	-33.3%	-5.3%
14	-5.6	-16.5%	0.5	-5.6	3.9%	2.2%
15	-9.5	-26.6%	-4.8	2.8	-15.3%	-12.4%
16	-0.7	-1.6%	3.0	0.1	2.2%	-1.5%
17	-1.3	-2.9%	-0.1	0.6	-0.5%	0.9%
Mean	-5.0	-12.2%	-1.0	1.6	-5.5%	-3.3%
Min	-17.0	-36.0%	-5.7	-5.6	-33.3%	-16.1%
Max	4.0	11.6%	4.0	13.8	6.3%	6.3%

Table 1

A summary of the data from parotids where the percentage of overlapping slices between either parotid and the PTV changed between initial scan and adaptation scan (only patients with non-zero change in overlap shown).

## CONCLUSIONS

This study showed that adapting the plan was effective in decreasing the mean dose to the parotids. The timing of plan adaptation, the change in the volume of the parotid and the amount of overlap of the parotids with the PTV have an impact on the degree of parotid mean dose sparing that can be achieved.

## CONTACT INFORMATION

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