The Influence of Regional Dose/Volume Metrics Patterns in Salivary Glands and Oral Cavity on Xerostomia: From Injury to Recovery

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PURPOSE / OBJECTIVE(s)

- Compare the regional radiation dose distribution in patients that develop xerostomia within 6 months of RT and those that recover from xerostomia within 18 months of RT.

- Find a model can be incorporated in DVH based treatment planning optimization process.

MATERIAL & METHODS

- Database and data collection

➤ Patient toxicity outcomes data have been collected prospectively at the point of care using Oncospace™.

- Outcome definition

➤ Injury: any xerostomia incidence (grade ≥ 2) within 6 months of radiotherapy.

➤ Recovery: injury, followed by a reduction of xerostomia score to < 2 before 18 months post-treatment.

- Feature generation

➤ Radio-morphology generation pipeline: 1) patients' anatomy (parotid gland [PG], submandibular gland [SMG]) was normalized to a standard patient, 2) sub volumes for each patients' regions of interest (ROI) were consistently derived through the geometric transformation, 3) patients' dose grid on each sub-volume was mapped and shape related DVH features was extracted.

➤ Oral cavity surrogate: as the area outside of PG, SMG and mandible, bounded superiorly by lower 2/3 of the PG, inferiorly by the inferior SMG, and anteriorly and posteriorly by the mandible.

- Statistical analysis

➤ Permutation tests with multiple comparison

➤ Feature importance was derived by ridge logistic regression.

➤ Nested Cross-validations to assess model performance.

RESULTS

Figure 1. Schematic of contour segmentation.

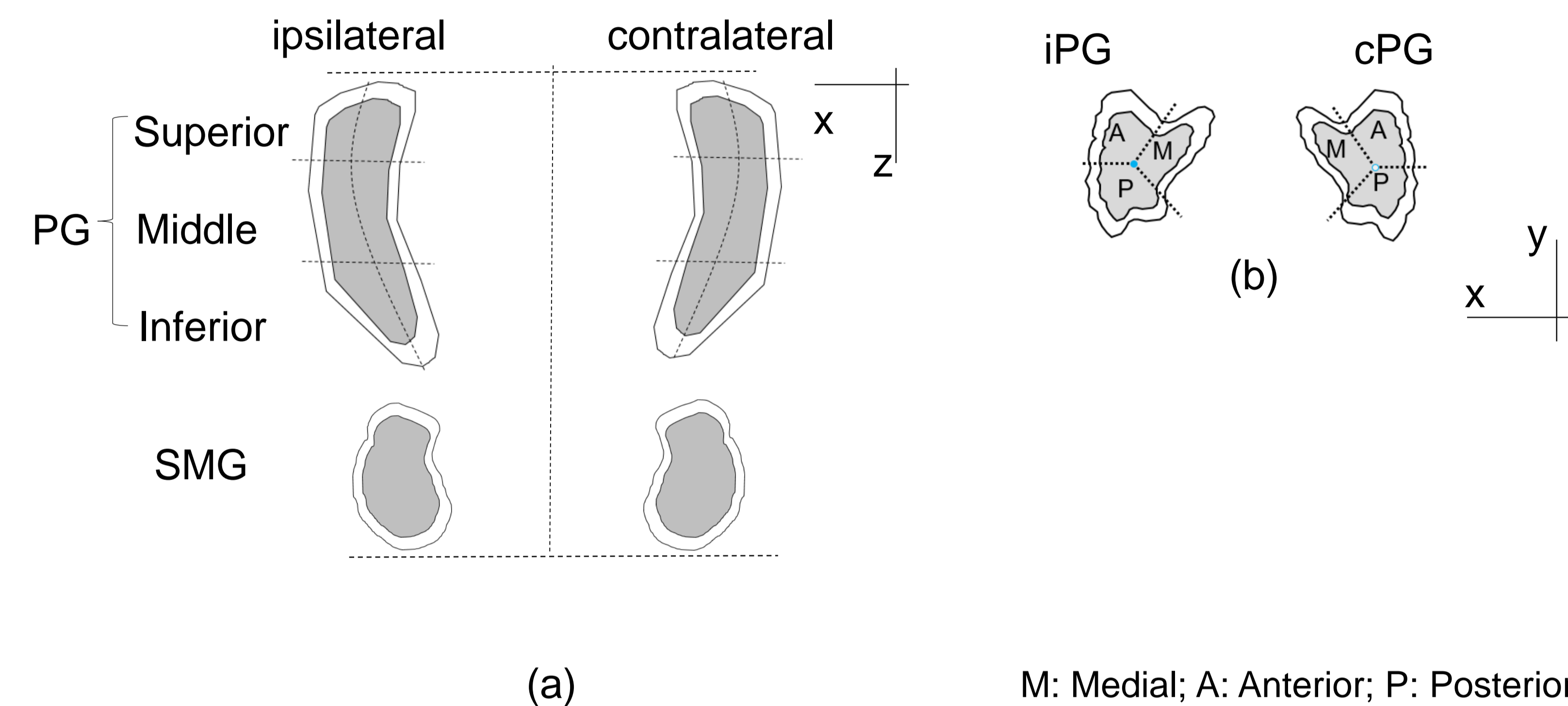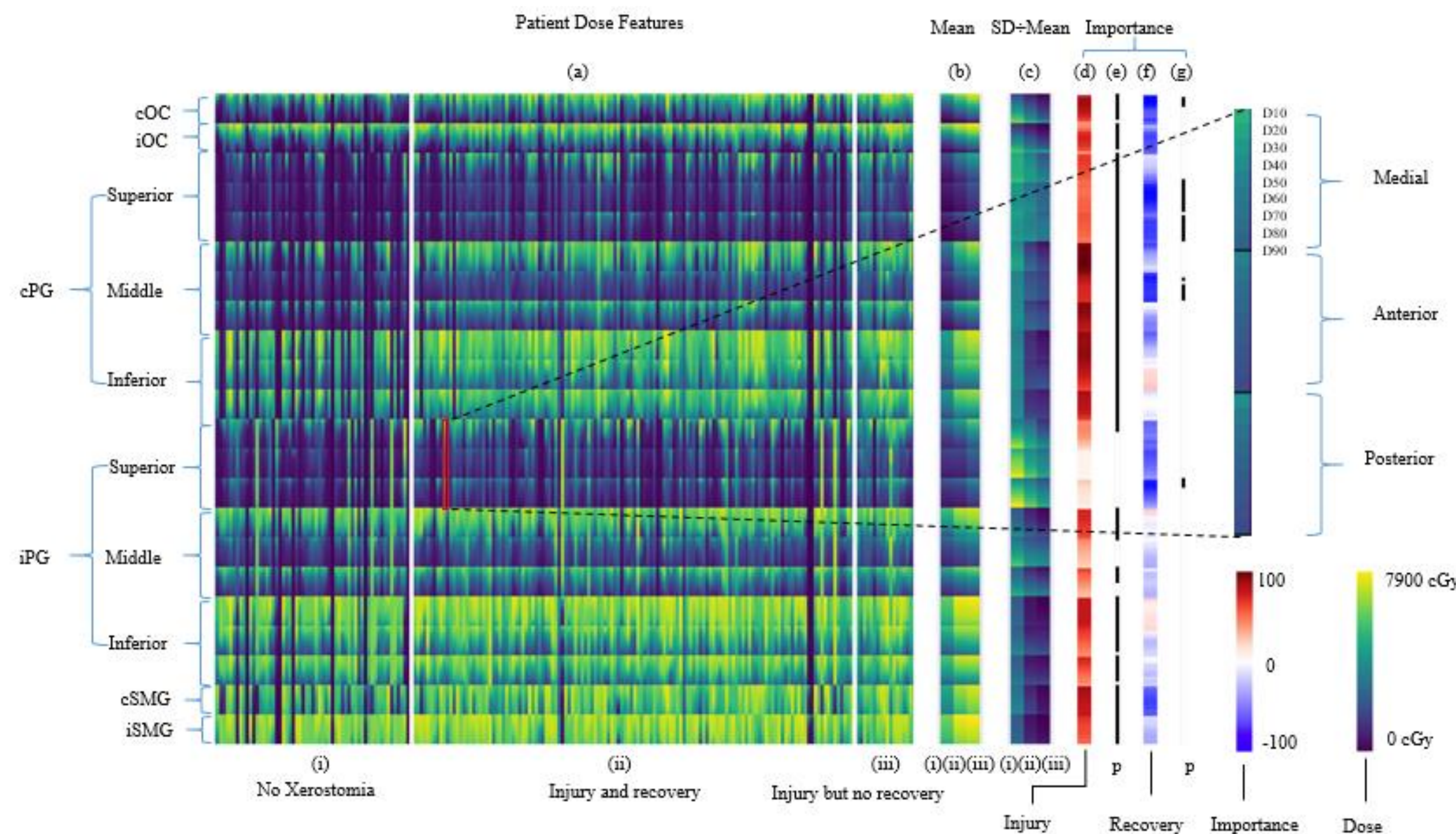M: Medial; A: Anterior; P: Posterior.

(a) (b)

Figure 2. Dose distribution and importance patterns for patients with (i) no xerostomia, (ii) injury and recovery, and (iii) injury but no recovery.

For each derived ROI, DVH features were calculated in 10% increments from D10 to D90

RESULTS (CONT'D)

Table 1. Nested Cross-Validation AUC for Xerostomia Injury and Recovery

Model	AUC±sd	Senstivity±sd	Specificity±sd
Injury	0.78±0.0009	0.77±0.003	0.74±0.008
Recovery	0.70±0.002	0.71±0.02	0.67±0.02

SUMMARY / CONCLUSION

- The influences of spatial dose patterns in salivary glands and oral cavity for xerostomia injury and recovery were different.

➤ Injury was dominated by high dose subvolumes and higher dose to smaller volume within both OCs, PGs and SMGs

➤ Recovery was dependent on low dose subvolumes within the superior iPG, superior and middle cPG, and cOC.

➤ Further research on identifying the spatial dose patterns within oral cavity related to injury and recovery is needed.

➤ More work is needed on quantitatively comparing variability between dose features that represent opposing hypotheses (e.g. low dose vs. high dose region, high dose to low volume vs. low-dose bath).

➤ Future validations are warranted to provide insights into applying selectively sparing strategies to treatment planning for injury prevention and recovery preservation.

ACKNOWLEDGEMENTS

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