



Evaluation of the Dixon-Derived Fat Fraction Changes in Lymphatic Tissues Following Radiotherapy

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BACKGROUND & PURPOSE

- Head and neck cancer (HNC) patients often experience late-effect lymphedema/fibrosis post-radiation therapy, leading to lower quality of life (QoL), reduced functional status, and increased symptoms burden.¹
- There are limited clinical techniques to quantify the severity of lymphedema/fibrosis, often relying on patient-reported outcome.

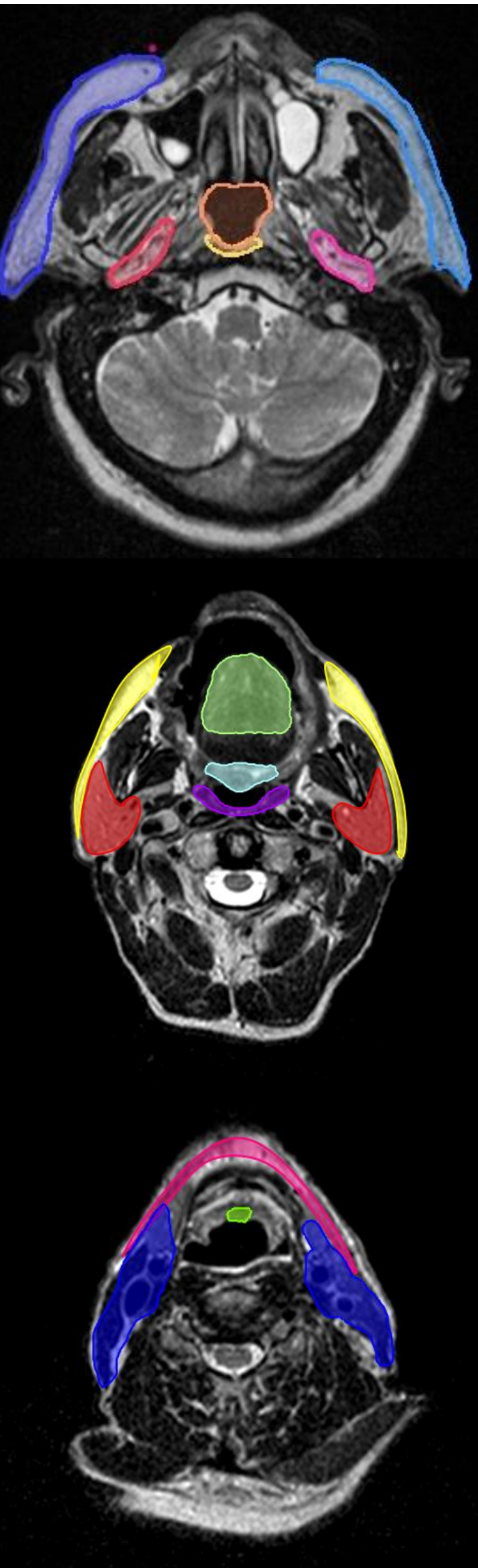
Purpose:

- To assess Dixon-derived fat fraction (FF) intensity metrics in lymphatic tissues of the head and neck, using manually segmented regions of interest (ROIs) from T2-weighted (T2W) anatomical MRI scans.
- To provide a preliminary report on the utility of fat fraction assessment as a monitoring biomarker for lymphedema in HNC patients undergoing radiotherapy.

METHODS

- Performed manual segmentation on ROIs from T2W MRI images of 9 patients in Velocity software.
- Co-registered T2W images and Dixon images to obtain intensity distributions for both fat and water within segmented ROIs.
- Median intensity values were used to compute the fat fractions and the FF distribution within ROIs from baseline to post-RT was obtained.
- Significant differences from baseline were assessed using Wilcoxon Signed Rank Test.

Segmented ROIs



Infraorbital Spaces (blue)

Buccofacial Spaces (yellow)

Preplatysma (pink)

FINDINGS

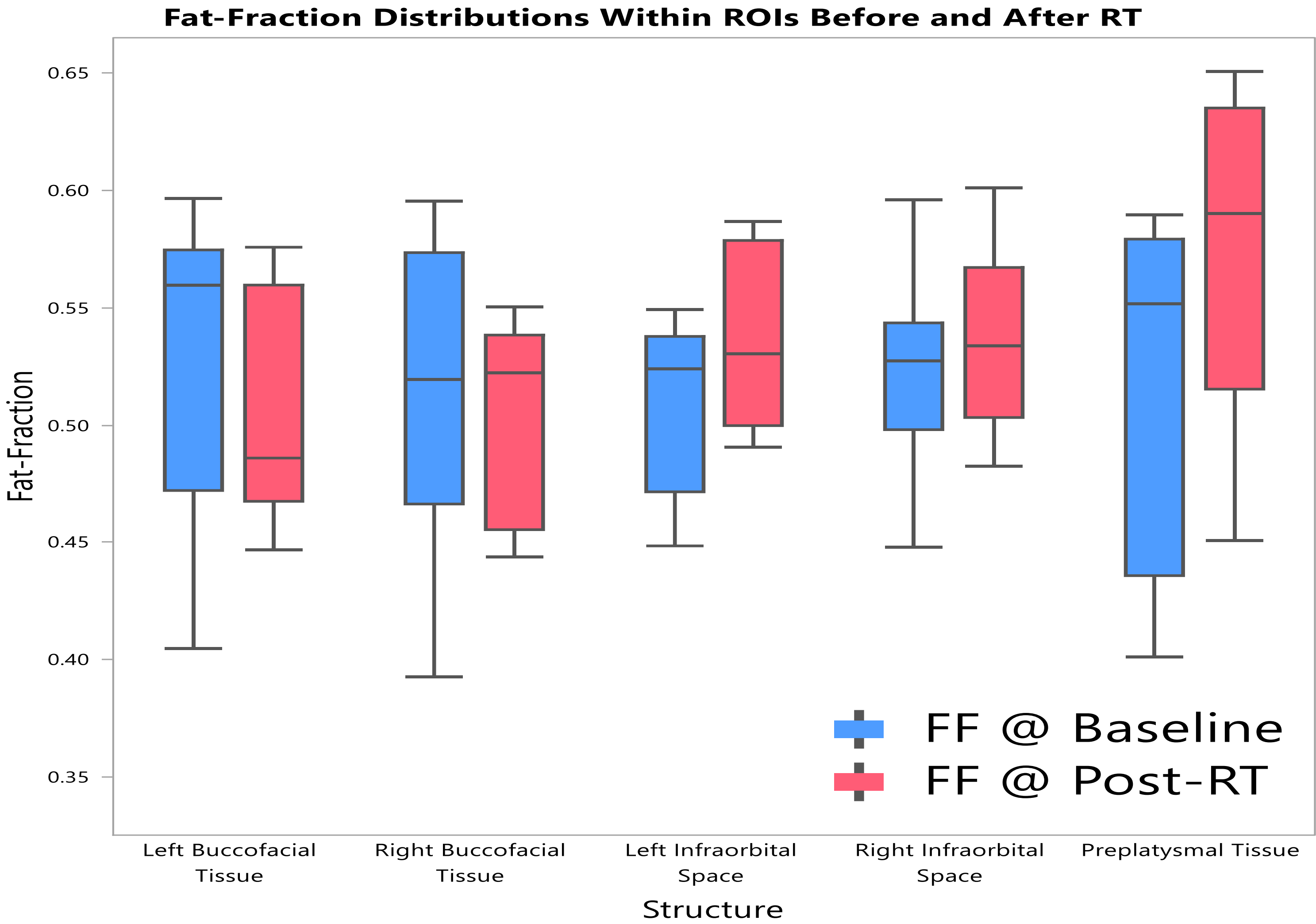


Fig. 1: Box Plot of Fat Fraction Distribution Across Key Anatomical Structures. The fat fraction values for various anatomical structures at two time points: baseline (FF_0) and post-radiotherapy (FF_2).

Structure	Mean FF Diff (Post-RT – Baseline)	Wilcoxon S	Two-sided p-value
Left Buccofacial Tissue	-0.0503	-11	0.0781
Right Buccofacial Tissue	-0.0405	-11	0.0781
Left Infraorbital Tissue	0.0098	0	1
Right Infraorbital Tissue	0.00048	-5	0.4688
Preplatysmal Tissue	0.04389	3	0.6875

Table 1: Statistical analysis results for fat fraction changes from baseline to post-RT within ROIs across different subjects.

RESULTS

- The median FF values for both the buccofacial and infraorbital tissues appear relatively stable from baseline to post-RT with minimal change
- The FF metrics for both the buccofacial and infraorbital tissues demonstrate what we expected because these ROIs receive, if at all, minimal radiation dose.
- A noticeable increase in the median FF of the preplatysmal tissue from baseline to post-RT is observed. This suggests a potential radiotherapy-induced injury, such as lymphedema/fibrosis development. This result looks very promising because, compared to the buccofacial and infraorbital tissues, the preplatysmal tissue receives more radiation dose during radiotherapy.
- However, the Wilcoxon Signed Rank Test results do not show any statistical difference in the FF changes within the ROIs from baseline to post-RT.

CONCLUSIONS

- There were both increases and decreases in FF observed across different ROIs after RT. Notably, the left buccofacial tissue displayed decreases in median FF, while the preplatysmal tissue showed an increase.
- The p-values for all ROIs were greater than 0.05, indicating that the observed changes in FF were not statistically significant.
- However, the results thus far are promising, particularly with the increase in FF seen in the preplatysmal tissue, and the lack of statistical significance might be due to preliminary analysis on a small sample size.
- This work is still ongoing, and a larger cohort and further analysis is needed to draw a definitive conclusion on these preliminary results and usefulness of the Dixon-derived FF metrics in quantifying lymphedema/fibrosis in lymphatic tissues.

REFERENCES & ACKNOWLEDGEMENTS

This work was funded by the Division of Radiation Oncology and the Sterling Foundation.

References:

1. Deng J et al. J Pain Symptom Manage. 2012;43:244-52.

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