

The Impact of Xerostomia on Diet Level and Feeding Tube Use Immediately Following Radiation Therapy for Head and Neck Cancer

Mathew B Vansant, PhD¹ ; Andrew McWhorter, MD² ; Melda Kunduk, PhD³ ; ¹University of Montevallo, Department of Communication Science and Disorders; ²Louisiana State University Health Sciences Center, Department of Otolaryngology-Head and Neck Surgery; ³Louisiana State University, Department of Communication Science and Disorders

Background: Organ preservation therapy (radiation therapy +\- chemotherapy) in head and neck cancer (HNC) has well recognized impacts on swallowing function and quality of life (QOL) (1-7).

- Treatment toxicity risks include xerostomia and mucositis, and their relationship to dysphagia and related QOL have been identified (1,2,5).
- Saliva is an important component of efficient swallowing moistening the bolus and lubricating the organs of deglutition (5).
- Xerostomia affects up to 95% of radiation patients leading to dental caries or ill-fitting dentures, oral pain or yeast, reduced or changed taste, dysphagia, and overall reduction in nutritional status (1).
- Previous research reported decline in the mean salivary weight from 5.1g (grams) pre-radiation to 1.4g three months post organ preservation treatment (5).
- The prescribed radiation thresholds for the salivary glands, ≤ 26 gray, is routinely leading to consistent xerostomia in the HNC population (6).
- To date, a 25% reduction in salivary function has been given as an arbitrary threshold of clinical significance (2).

However, limited data exists between the radiation induced xerostomia and the impact on patients’ diet level and risk of enteral feeding.

Purpose: To determine the relationship between xerostomia (salivary weight) during radiation+/- CT to changes in diet level and feeding tube placement.

Methods: Thirty patients with a HNC diagnosis beginning radiation therapy (with or without chemotherapy) and no pre-radiation feeding tube placement were prospectively enrolled in this study. Patients had no surgical intervention other than biopsy. Patients’ saliva was measured as salivary weight using a Saxon test (8), a two-minute gauze chew test. Salivary production data were collected pre- and immediately post-radiation Outcome measures include feeding tube (PEG) use and Functional Oral Intake Scale (FOIS) levels. See Table 1.

Statistical analyses: IBM SPSS Statistics version 25 was used to conduct all correlation and regression analyses. Predictive model: % salivary loss = +/-PEG coefficient value x post-radiation PEG value + the constant

Results: Results highlighted new objective measurement data and established a new quantifiable range of salivary loss related to diet level or feeding tube use.

- Mean Salivary Loss was 69.83%
- Salivary loss was significantly correlated to PEG use (r -.403, p .027) and FOIS level (r .395, p .031).
- The predictive model for FOIS found a **salivary loss of 74.85% - 88.68% was predictive of feeding tube use (FIOS level 2, 3) to complete dependence (FOIS level 1).** (Table 2)
- The predictive model for PEG use found **salivary losses of 83.25% or greater associated with post-radiation PEG use.**
- Additionally, a salivary loss of 47.18% was associated with the ability to maintain a normal unaltered diet, FOIS level 7.

Table 1. Patient Demographics, Chemotherapy Status, Radiation Dose, Post-Radiation FOIS, PEG USE, and Salivary Loss									
Subject	Age	Sex	Tumor Site	Cancer Stage	Chemo-therapy	Radiation Dose	Post-Radiation PEG	Post-Radiation FOIS Score	% Post-Radiation Salivary Loss
1	65	Male	Bot	III	Yes	70 Gy	No	4	-76.52
2	53	Male	Bot	III	Yes	70 Gy	Yes	2	-87.18
3	44	Male	Larynx	III	Yes	70 Gy	No	5	-38.01
4	61	Male	Bot	II	Yes	70 Gy	No	4	-78.22
5	65	Male	Tonsil	IV	Yes	70 Gy	Yes	2	-81.29
6	44	Male	Pharynx	IV	Yes	70 Gy	No	4	-82.11
7	66	Male	Tonsil	II	Yes	70 Gy	Yes	3	-87.13
8	70	Female	Tonsil	I	No	70 Gy	No	4	-6.82
9	65	Male	Tonsil	IV	No	70 Gy	No	4	-22.80
10	66	Male	Bot	III	Yes	70 Gy	Yes	3	-97.08
11	68	Male	Bot	III	No	70 Gy	No	3	-89.04
12	59	Female	Tonsil	IV	Yes	70 Gy	No	4	-89.10
13	69	Male	Bot	III	Yes	70 Gy	No	4	-89.49
14	59	Male	Bot	III	Yes	70 Gy	No	5	-91.46
15	54	Male	Larynx	III	Yes	70 Gy	No	4	-49.23
16	76	Female	Larynx	III	Yes	70 Gy	No	4	-17.50
17	58	Male	Larynx	III	No	70 Gy	No	4	-44.94
18	54	Male	Tonsil	III	Yes	70 Gy	Yes	2	-86.14
19	61	Male	Tonsil	III	Yes	70 Gy	No	4	-74.50
20	52	Male	Bot	III	Yes	70 Gy	No	5	-4.39
21	65	Male	Larynx	II	Yes	70 Gy	No	4	-82.53
22	54	Male	Tonsil	IV	No	70 Gy	No	4	-64.37
23	64	Male	Tonsil	IV	Yes	70 Gy	No	5	-65.41
24	57	Male	Tonsil	IV	Yes	70 Gy	No	4	-74.29
25	64	Female	Pharynx	III	Yes	70 Gy	Yes	1	-95.47
26	57	Male	Tonsil	IV	Yes	70 Gy	No	4	-85.57
27	54	Male	Tonsil	III	Yes	70 Gy	No	5	-76.86
28	71	Male	Pharynx	III	Yes	70 Gy	Yes	2	-89.59
29	76	Male	Bot	III	Yes	70 Gy	No	4	-77.64
30	76	Male	Tonsil	III	Yes	70 Gy	No	5	-90.30

Bot, Base of Tongue; FOIS, Functional Oral Intake Scale, PEG, Percutaneous Endoscopic Gastronomy Tube; Gy, Gray; %, Percentage of Salivary Loss During Radiation treatment

Table 2. Predicted Percentage of Salivary Loss for FOIS Levels, n = 30							
	FOIS Level						
	1	2	3	4	5	6	7
% of Predicted Saliva Loss	88.68	81.76	74.85	67.96	61.01	54.1	47.18
(FOIS) Functional Oral Intake Scale, (%) Percentage							

- Conclusions:**
- These results provide an objective level to measure the effectiveness of current and future treatment methodologies designed to protect and/or restore salivary function.
 - These results suggest that a non-arbitrary level of 54.1% salivary loss is correlated with initial declines in diet level
 - Additionally, a salivary loss of 47.18% was correlated with the ability to maintain a normal unaltered diet, FOIS level 7.
 - Future studies are needed to investigate the relationship between salivary loss and diet level/feeding tube use.

- Limitations:**
- Sample size is a limitation of this study.
 - A further limitation includes the single treatment site where data were collected, other treatment sites may have different treatment protocols resulting in a different outcome.

References: 1. Bruce SD. Radiation-induced xerostomia: how dry is your patient? [corrected] [published erratum appears in Clin J Oncol Nurs 2004 Apr;8(2):116]. Clin J Oncol Nurs. 2004;8(1):61-7.; 2. Dirix P, Nuyts S, Van den Bogert W. Radiation-induced xerostomia in patients with head and neck cancer: a literature review. Cancer. 2006;107(11):2525-34.; 3. Lazarus CL, Husaini H, Jacobson AS, Mojica JK, Buchbinder D, Okay D, et al. Development of a new lingual range-of-motion assessment scale: normative data in surgically treated oral cancer patients. Dysphagia. 2014;29(4):489-99.; 4. Lazarus CL, Husaini H, Hu K, Culliney B, Li Z, Urken M, et al. Functional outcomes and quality of life after chemoradiotherapy: baseline and 3 and 6 months post-treatment. Dysphagia. 2014;29(3):365-75.; 5. Logemann JA, Smith CH, Pauloski BR, Rademaker AW, Lazarus CL, Colangelo LA, et al. Effects of xerostomia on perception and performance of swallow function. Head Neck. 2001;23(4):317-21.; 6. Martin E, Deville C, Bonnetan F, Bosset M, Créange G, Truc G, et al. Head and neck IMRT: Intensity-modulated radiation therapy in head and neck cancer: Prescribed dose, clinical challenges and results. Radiother Oncol. 2007;85:392-8.; 7. Wygoda A, Rutkowski T, Hutnik M, Skladowski K, Golen M, Pilecki B. Acute mucosal reactions in patients with head and neck cancer. Three patterns of mucositis observed during radiotherapy. Strahlenther Onkol. 2013;189(7):547-51.; 8. Kohler PF, Winter ME. A quantitative test for xerostomia. The saxon test, an oral equivalent of the schirmer test. Arthritis Rheum. 1985;28(10):1128.