



Head and Neck Cancer: Part 1

Prevalence and Treatment Modalities

Loni Arrese, PhD

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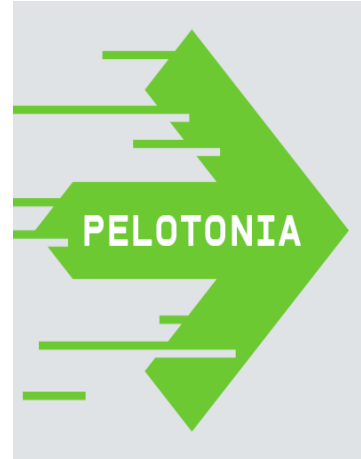


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Disclosures

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Outline

- Prevalence of Head and Neck Cancer (HNC)
- Oncologic Treatment Options for HNC
- Framework for baseline and proactive speech pathology services in a multidisciplinary clinic

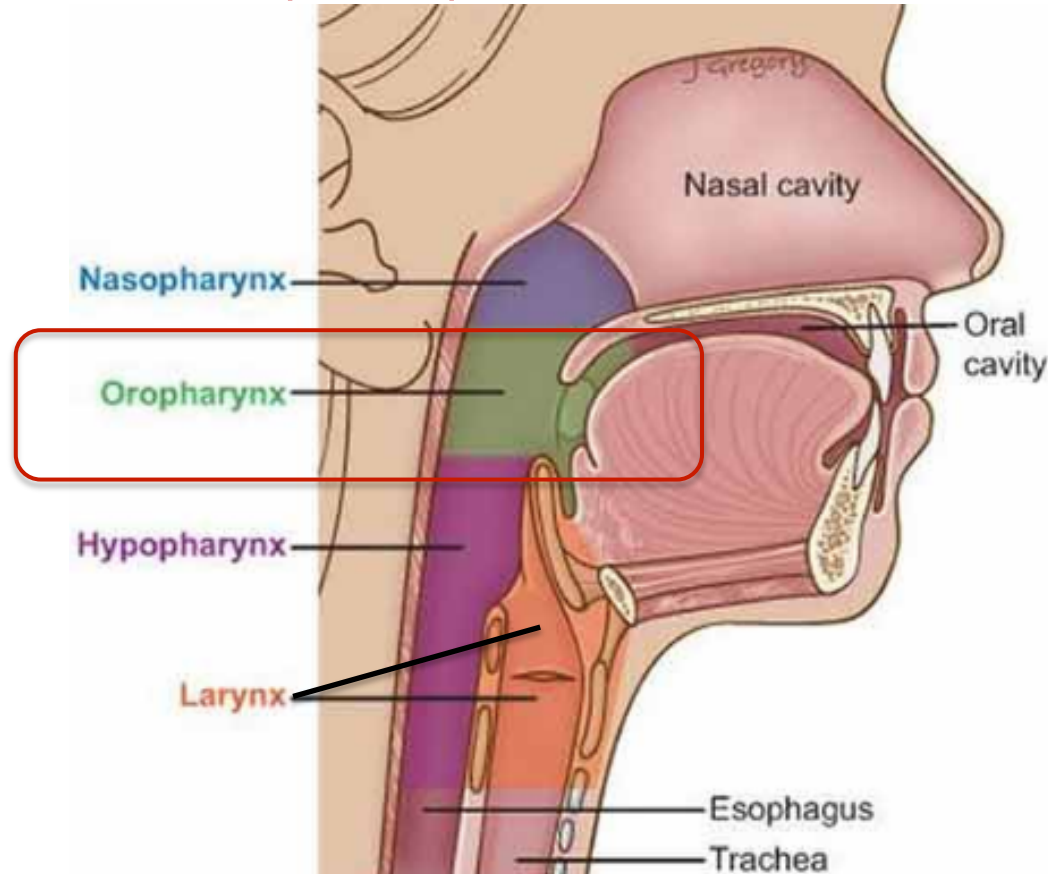
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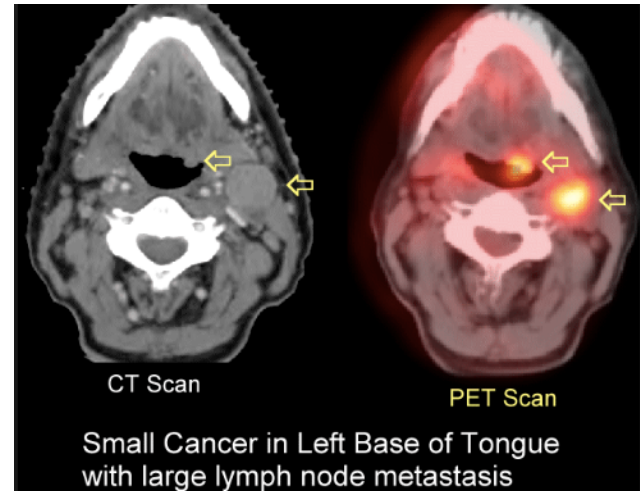
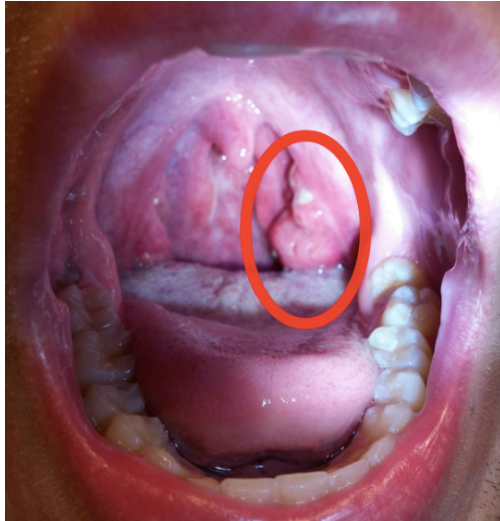
Head and Neck Cancer (HNC)

- Nasal Cavity
- Oral cavity
- Oropharynx
- Hypopharynx
- Larynx
- Salivary Gland



Prevalence of Head and Neck Cancer

- Despite a decrease in prevalence of smoking in the USA
 - Decrease in smoking related cancers
- Dramatic increase in prevalence of oropharyngeal cancer due to a virally mediated form → HPV.



Human Papilloma Virus (HPV)

- Sexually transmitted infection.
- Very common in the U.S.
- In some, oral HPV leads to HPV associated HNC (viral DNA infection).

HEAD & NECK CA

- Epidemiologic shift: HPV+, non-smoker, non-drinker

“New” head and neck patient (Deschler et. al, 2014)

Males > females in their 40s and 50s

High cure rates (Chaturvedi et. al, 2008)

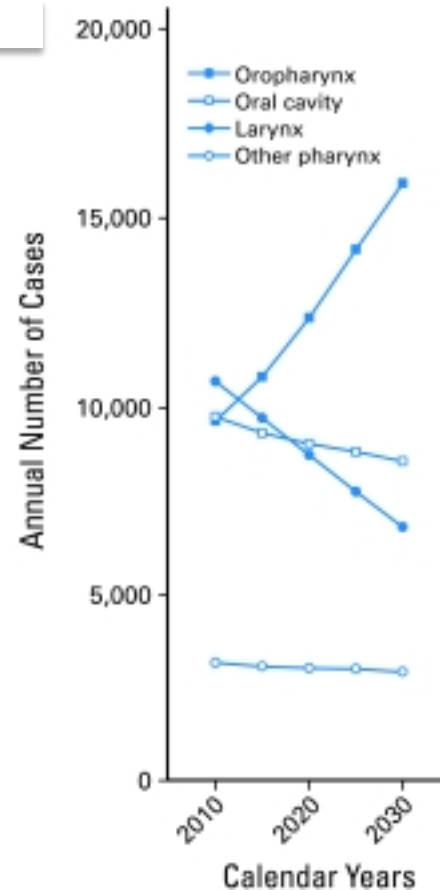
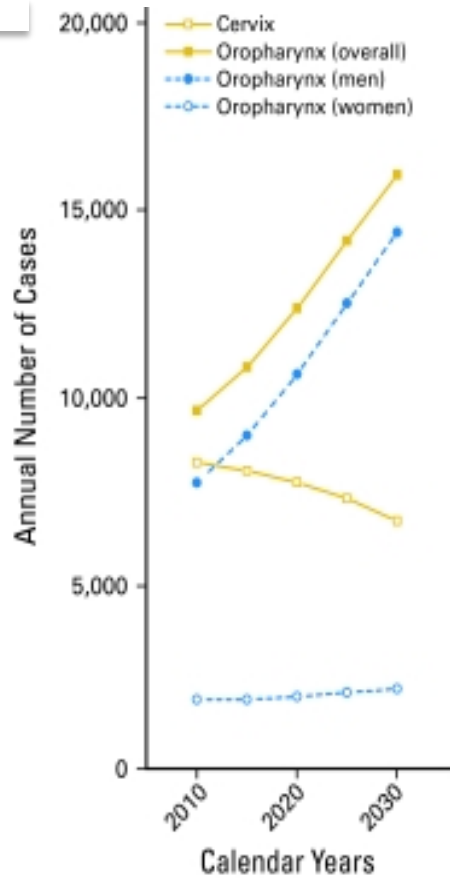
- Younger survivors living with treatment-induced side effects, DYSPHAGIA.

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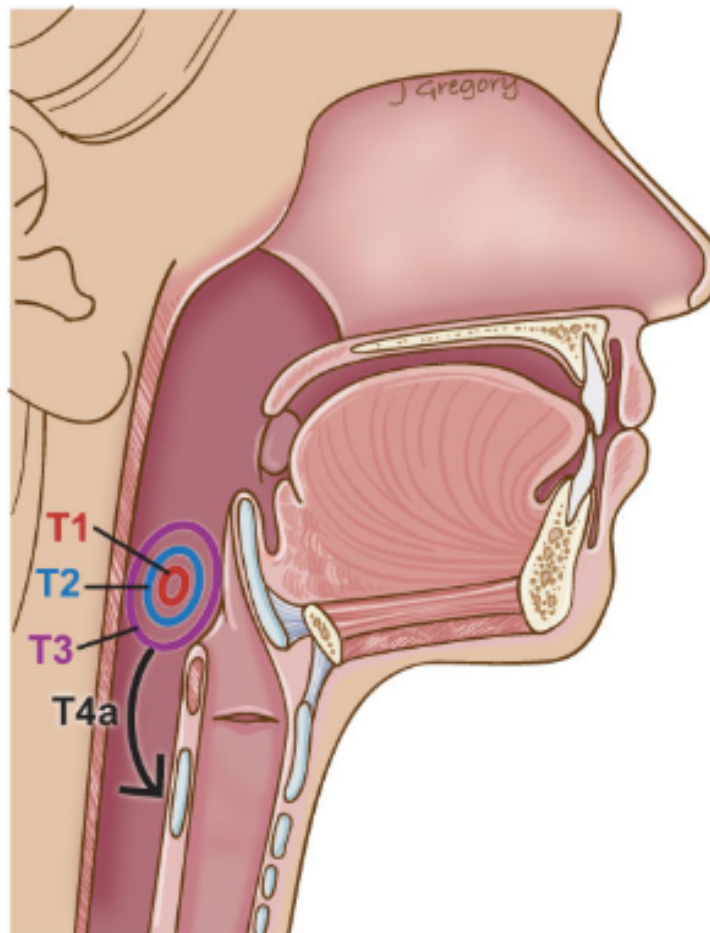
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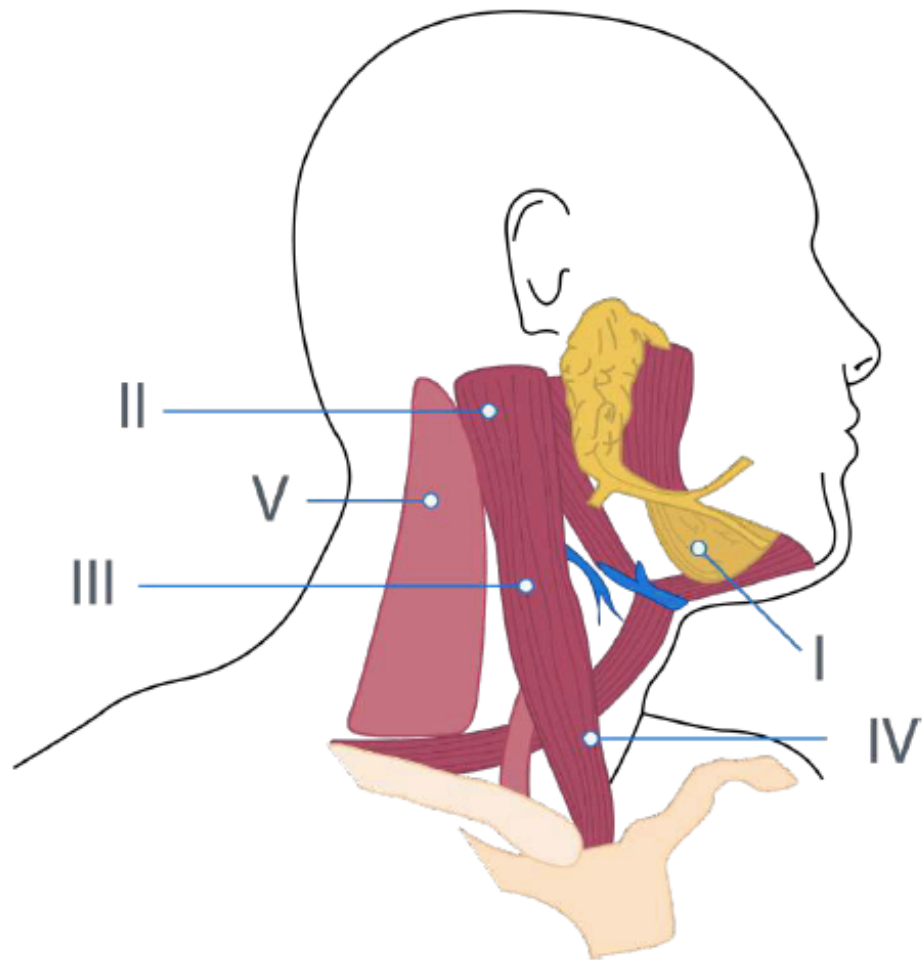
TNM Staging Model

- **T**: tumor size and/or location
- **N**: degree of lymph node involvement
- **M**: presence or absence of distant metastasis

TNM Classification

T: Tumor size or extent of involvement	TX: Primary tumor cannot be assessed
	T0/Tis: Unknown primary
	T1: Tumor ≤ 2 cm greatest dimension
	T2: Tumor $> 2\text{cm} < 4$ cm in greatest dimension
	T4: Tumor invades adjacent structures
N: Nodal Involvement	NX: Regional lymph nodes cannot be assessed
	N0: No regional lymph nodes
	N1: Single ipsilateral node ≤ 3 cm
	N2(a-c): Single ipsilateral node 3-6 cm, or multiple nodes < 6 cm
	N3 (a,b): > 6 cm, single or multiple
M: Metastases	MX: Distant metastases cannot be assessed
	M0: No distant metastases present
	M1: Distant metastases (most commonly lung)





AJCC Staging	N0	N1	N2	N3
T1	I	III	IV	IV
T2	II	III	IV	IV
T3	III	III	IV	IV
T4	IV	IV	IV	IV

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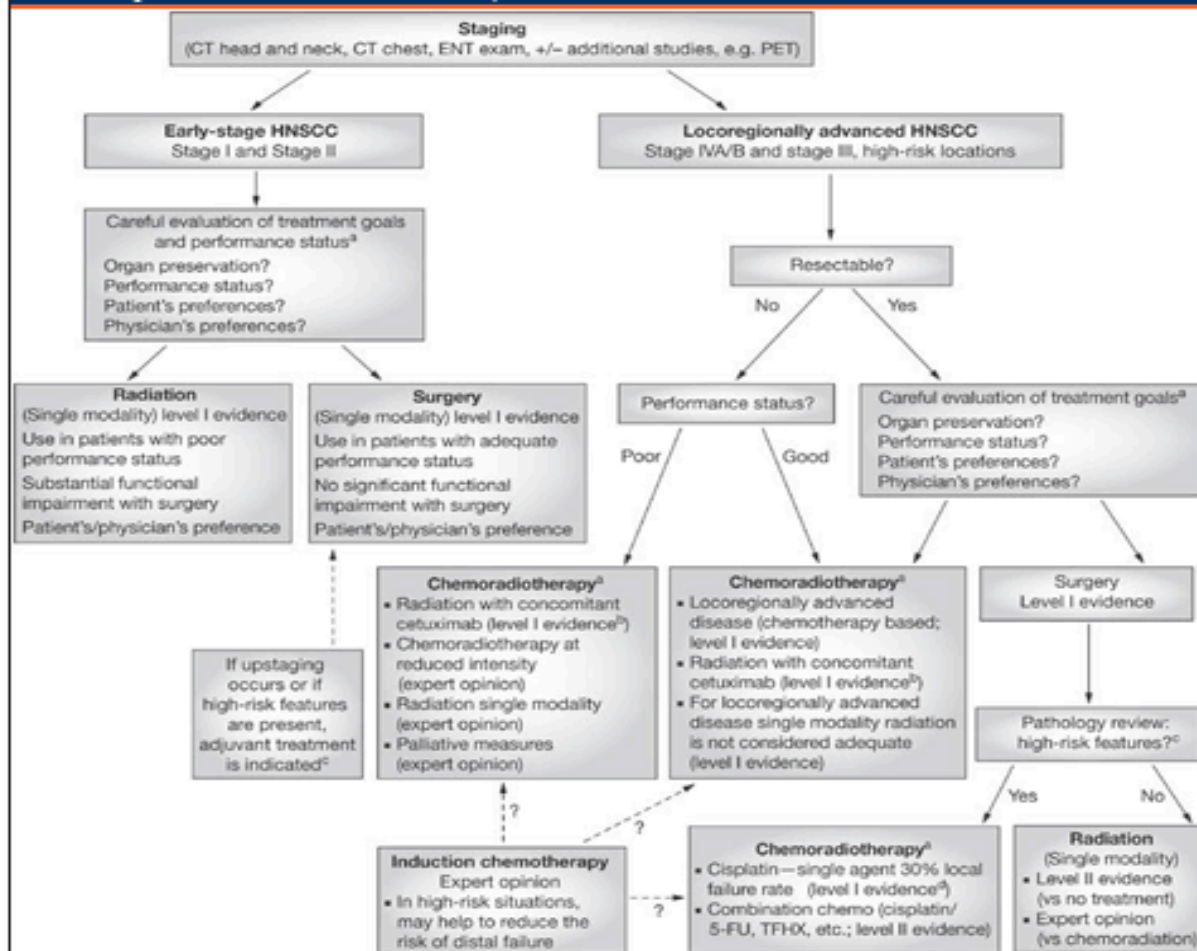
HPV+ Staging	N0	N1	N2	N3
T0	N/A	I	II	III
T1	I	I	II	III
T2	I	I	II	III
T3	II	II	II	III
T4	III	III	III	III

* Stage IV is reserved for metastatic disease

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Head and Neck Cancer – Induced Dysphagia

- May be secondary to mechanical effects of the tumor.
- Tumor-related pain.
- A direct sequela of oncologic treatment.

Head and Neck Cancer – Induced Dysphagia

- As high as 40% at initial cancer diagnosis (Stenson et al., 2000).
- As many as 70% of HNC patients are left with permanent swallowing deficits following cancer treatment (Nguyen et al., 2002).
- Silent aspiration can be as high as 18.5% at time of cancer diagnosis and range from 22-65% after cancer treatment (Denaro et al., 2013).
- Discrepancies between patient perceived impairment and pathophysiology (Rogus-Pulia et al. 2014; Arrese, et al., 2017).

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Baseline Assessment Components

- Patient reported outcomes
 - Pain
 - Swallowing
 - Speech
- Measures of strength and range of motion
- Speech sample
- Swallowing Assessment

OUTCOME MEASURES

- Patient perceived Impairment EAT-10
- Functional Oral Intake Scale (FOIS)
- Maximum Mandibular Opening MMO
- Anterior lingual pressure
- Reported pain level
- Mucositis Rating (CTCAE)
- Instrumental Assessment

Eating Assessment Tool – 10 (EAT-10)

<i>To what extent are the following scenarios problematic to you?</i>	0	1	2	3	4
1. My swallowing problem has caused me to loose weight					
2. My swallowing problem interferes with my ability to go out for meals					
3. Swallowing liquids takes extra effort					
4. Swallowing solids takes extra effort					
5. Swallowing pills takes extra effort					
6. Swallowing is painful					
7. The pleasure of eating is affected by my swallowing					
8. When I swallow food sticks in my throat					
9. I cough when I eat					
10. Swallowing is stressful					

Functional Oral Intake Scale (FOIS)

LEVEL	DIET LEVEL:
Tube Dependent	1. No oral intake
	2. Tube dependent with minimal oral intake
	3. Tube dependent with consistent oral intake of liquid or food
Total Oral Intake	4. Total oral intake of a single consistency
	5. Total oral intake with multiple consistencies - special preparation
	6. Total oral intake - no special preparation, must avoid specific foods
	7. Total oral intake with no restrictions

TheraBite Range of Motion Scale

How to Measure MMO Using the TheraBite®:

- Instruct the patient “I will place this opening on your bottom tooth or gum, you will open as wide as you can, and I will read the number that contacts your top tooth or gum”
- Place the notch on the patients lower central incisor
- Verbally instruct and encourage the patient to stretch their jaw open as wide as they can
- Read the number that contacts the bottom edge of the top incisor or gum



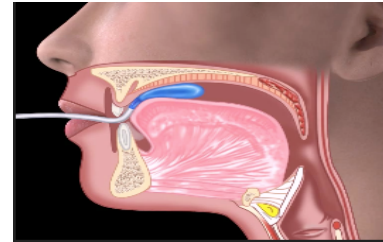
Lingual Strength



The Iowa Oral Performance Instrument (IOPI) objectively measures:
1) Tongue strength and endurance 2) Lip strength and endurance

How to Measure Lingual Strength Using the IOPI:

- ✓ Instruct the patient “Using your entire tongue, push the bulb against the roof of your mouth as hard as you can.”
- ✓ Have the patient open their mouth and place the bulb on top of the tongue in the “anterior” position – the hard palate just behind the alveolar ridge
- ✓ Have the patient gently close their mouth around the tubing with the bulb in place
- ✓ Instruct and encourage the patient to push



Head and Neck Cancer – Induced Dysphagia

- HNC patients often report that their swallowing is superior to actual performance observed during fluoroscopy or endoscopy (Kendall et al., 2014; Lazarus, 1993).
- Less than half of dysphagic patients report their dysphagia symptoms to health care professionals unless they are directly asked about their swallowing-related difficulties (Cichero & Clave, 2012; Ekberg et al., 2002).
- **However.....** Patient report remains an essential aspect of dysphagia management.

Importance of Dysphagia



Relationship Between the Eating Assessment Tool-10 and Objective Clinical Ratings of Swallowing Function in Individuals with Head and Neck Cancer.

Arrese LC¹, Carrau R², Plowman EK³.

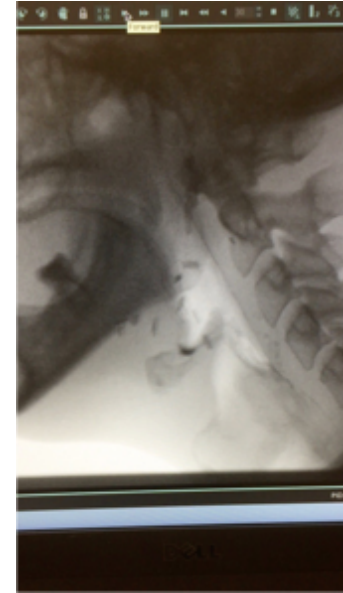
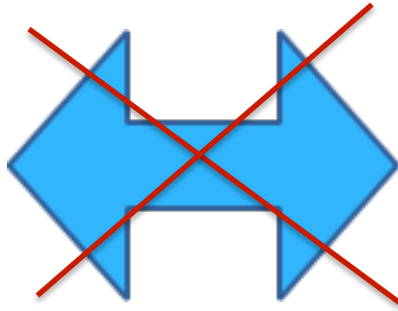
Table 4 Correlations between outcome measures for each group

Group	EAT-10 and summed MBSImP composite scores (oral and pharyngeal)	EAT-10 and MBSImP pharyngeal composite score	EAT-10 and PAS
1 (<i>n</i> = 19)	<i>r</i> = 0.66, <i>p</i> = 0.002*	<i>r</i> = 0.70, <i>p</i> < 0.001*	<i>r</i> = 0.66, <i>p</i> = 0.002*
2 (<i>n</i> = 8)	<i>r</i> = 0.25, <i>p</i> = 0.557	<i>r</i> = 0.27, <i>p</i> = 0.514	<i>r</i> = -0.06, <i>p</i> = 0.891
3 (<i>n</i> = 17)	<i>r</i> = 0.17, <i>p</i> = 0.505	<i>r</i> = 0.30, <i>p</i> = 0.237	<i>r</i> = 0.07, <i>p</i> = 0.775

* Denotes statistical significance at *p* < 0.01

Patient Report and Objective Pathophysiology

**Eating Assessment Tool-10
(EAT-10)**



Dysphagia. 2016 Aug 18.

Relationship Between the Eating Assessment Tool-10 and Objective Clinical Ratings of Swallowing Function in Individuals with Head and Neck Cancer.

Arrese LC, Carrau R, Plowman EK.

54 y/o male
H/o: Nasopharyngeal Ca
Completed chemoradiation therapy
in 2003

EAT-10 score = 12/40
MBSImP = 35/51

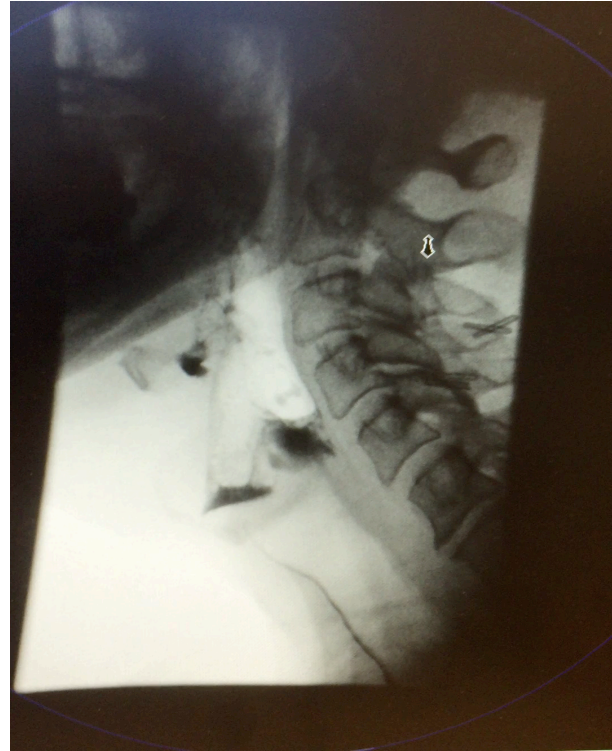


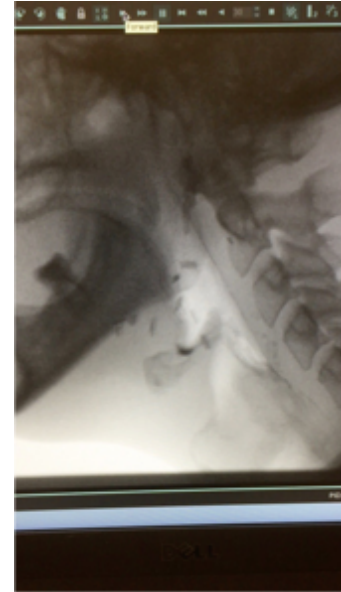
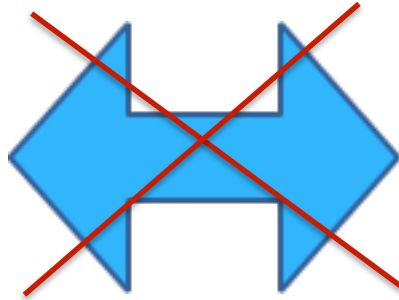
Table 5 Correlations between the EAT-10 and MBSImPTM© scores for Group 1

Question number	EAT-10 question	Correlation between EAT-10 and MBSImP TM © scores
2	My swallowing problem interferes with my ability to go out for meals	$r = 0.746, p < 0.001^*$
5	Swallowing pills takes extra effort	$r = 0.704, p = 0.001^*$
3	Swallowing liquids takes extra effort	$r = 0.670, p = 0.002^*$
10	Swallowing is stressful	$r = 0.640, p = 0.003^*$
7	The pleasure of eating is affected by my swallowing	$r = 0.621, p = 0.005^*$
4	Swallowing solids takes extra effort	$r = 0.581, p = 0.009$
1	My swallowing problem has caused me to lose weight	$r = 0.504, p = 0.028$
9	I cough when I eat	$r = 0.318, p = 0.185$
8	When I swallow food sticks in my throat	$r = 0.315, p = 0.189$
6	Swallowing is painful	$r = 0.002, p = 0.994$

* Denotes statistical significance at $p < 0.005$

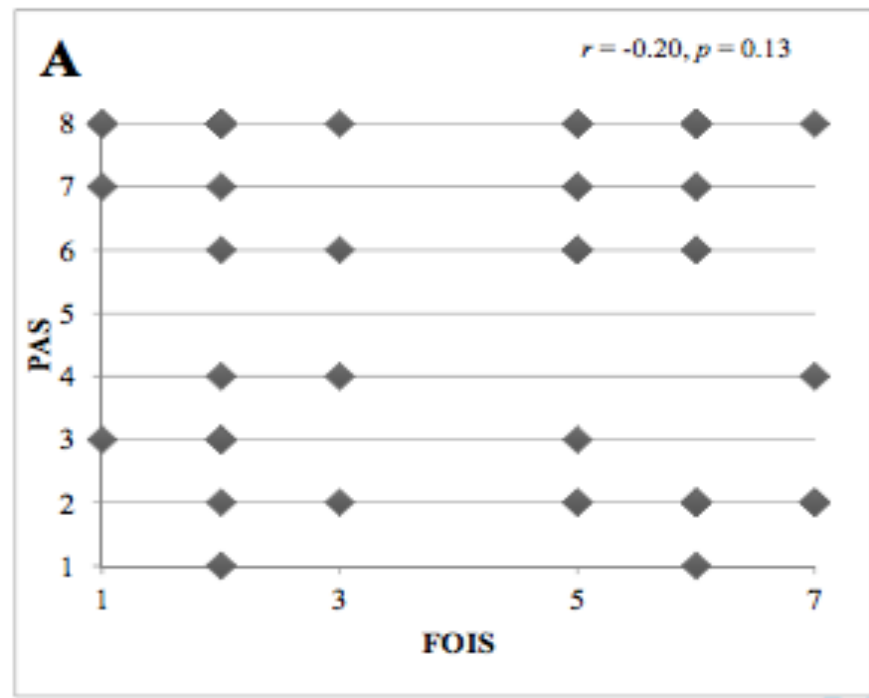
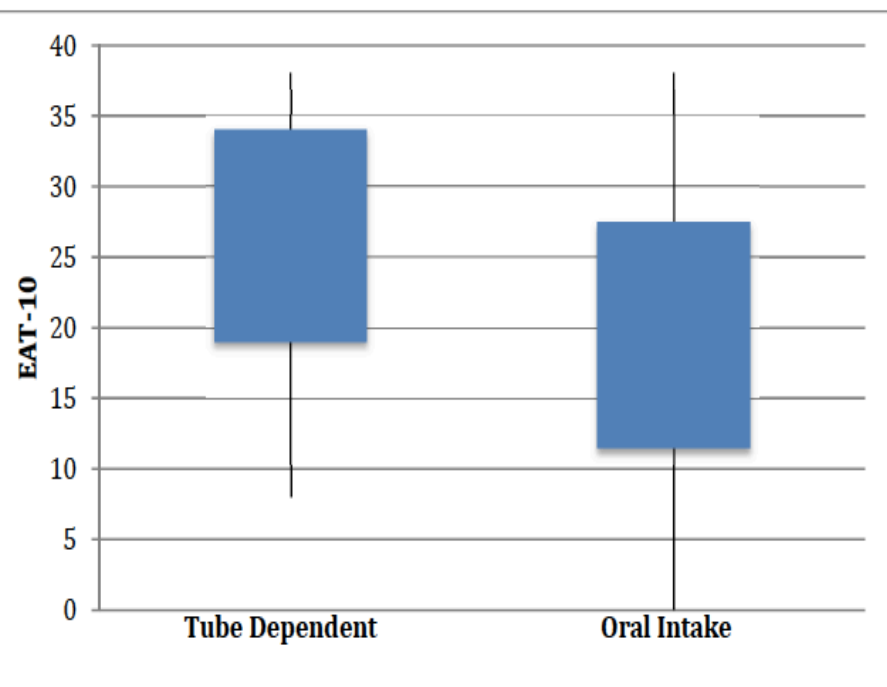
Patient Oral Intake

FIOS



Relationship between oral intake, patient perceived swallowing impairment, and objective videofluoroscopic measures of swallowing in head and neck cancer patients.

Arrese et al.



Treatment for HNC

- Surgery
- Radiation Therapy
- Chemotherapy
- Biologic Agents
- Multimodality

Squamous cell carcinoma of the oropharynx: surgery, radiation therapy, or both.

Parsons JT¹, Mendenhall WM, Stringer SP, Amdur RJ, Hinerman RW, Villaret DB, Moore-Higgs GJ, Greene BD, Speer TW, Cassisi NJ, Million RR.

- 6,400 patients across 51 studies
- Two standard approaches:
 - Surgery +/- RT
 - RT +/- neck dissection
- Equivalent survival and local regional control
- Complications in the surgical group

Surgery



Anatomical Defects

V
VII
IX
X
XII

Radiation/
Chemoradiation



“Organ
sparing”

Anatomical Defects



Dysphagia

Predictable
Dependent upon
location
of resection
and clinical T stage

“Organ sparing”



Dysphagia

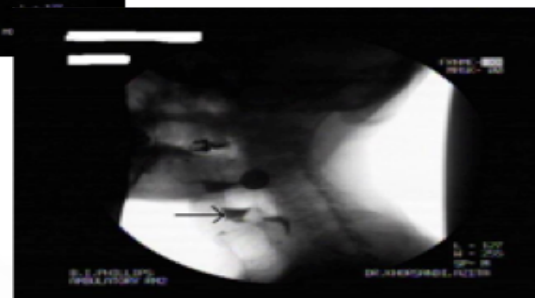
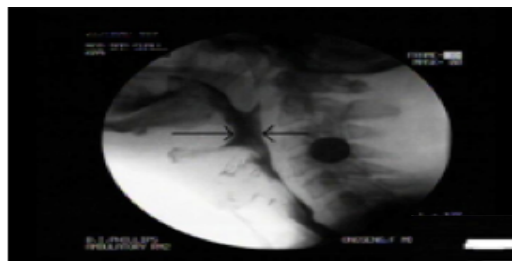
Dependent upon
Tumor Size
Neck Disease

V
VII
IX
X
XII

Surgery



Radiation/
Chemoradiation



Chemoradiation



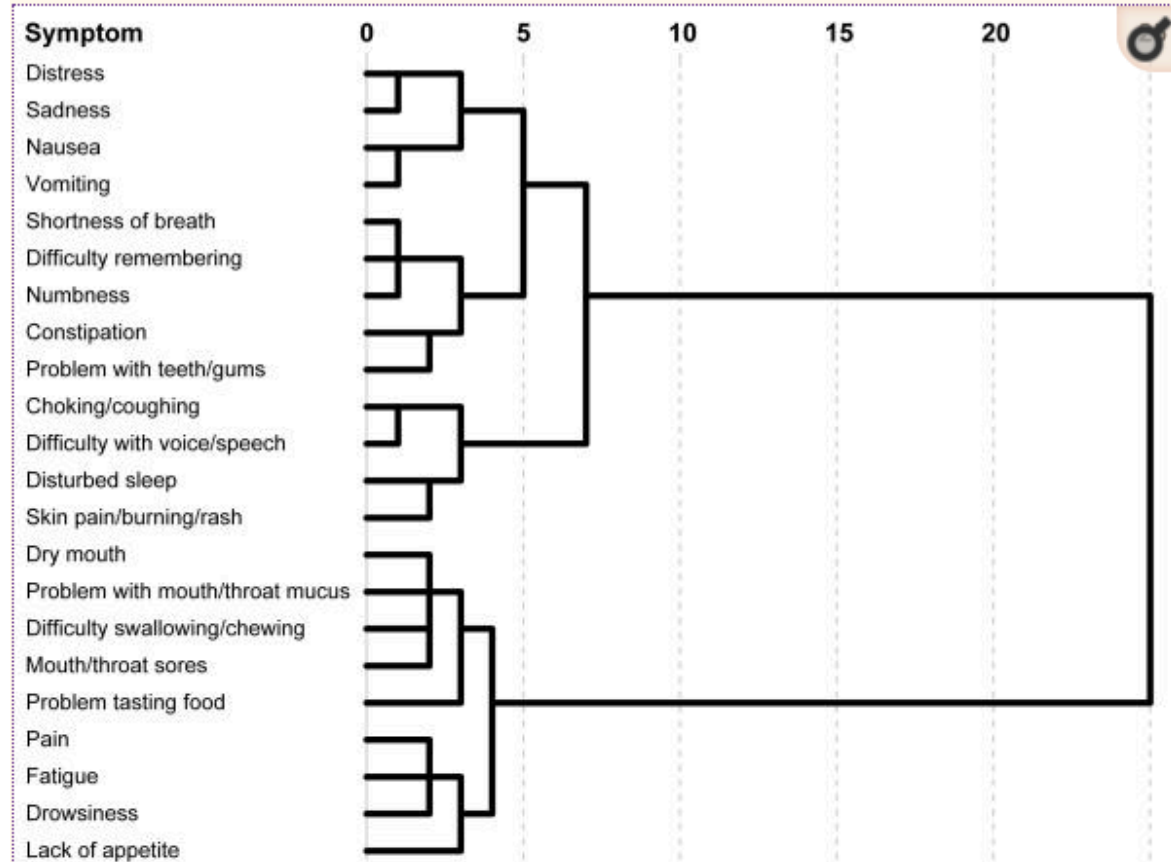
Radiotherapy

- Intensity-modulated radiation therapy (IMRT) and volumetric arch therapy (VMAT) - standard of care
- Acute and late effects of radiation on normal tissues are dependent on:
 - RT field
 - Dose per fraction
 - Number of fractions, (including fractions per day)
 - Inter-fraction interval
 - Total dose
 - Duration over which the dose is delivered

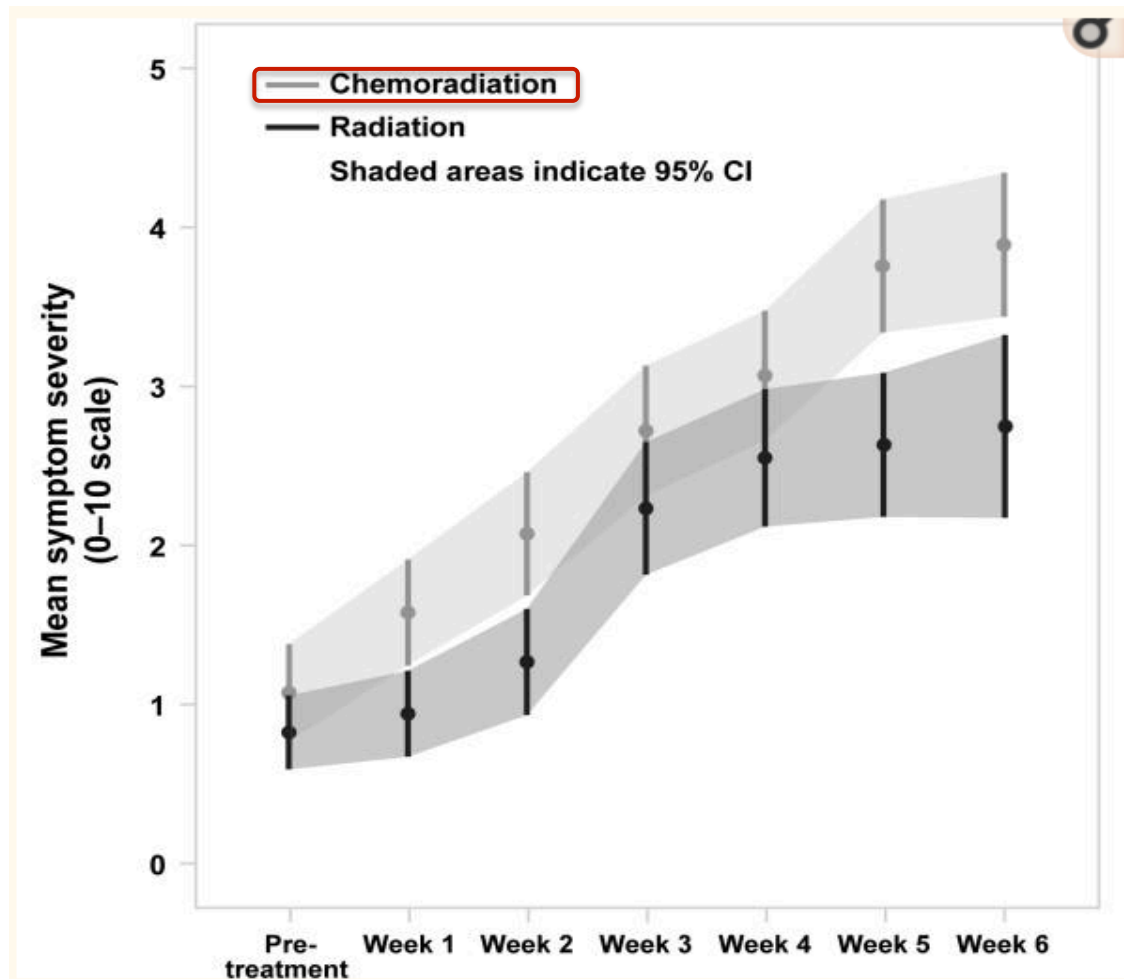
Chemotherapy

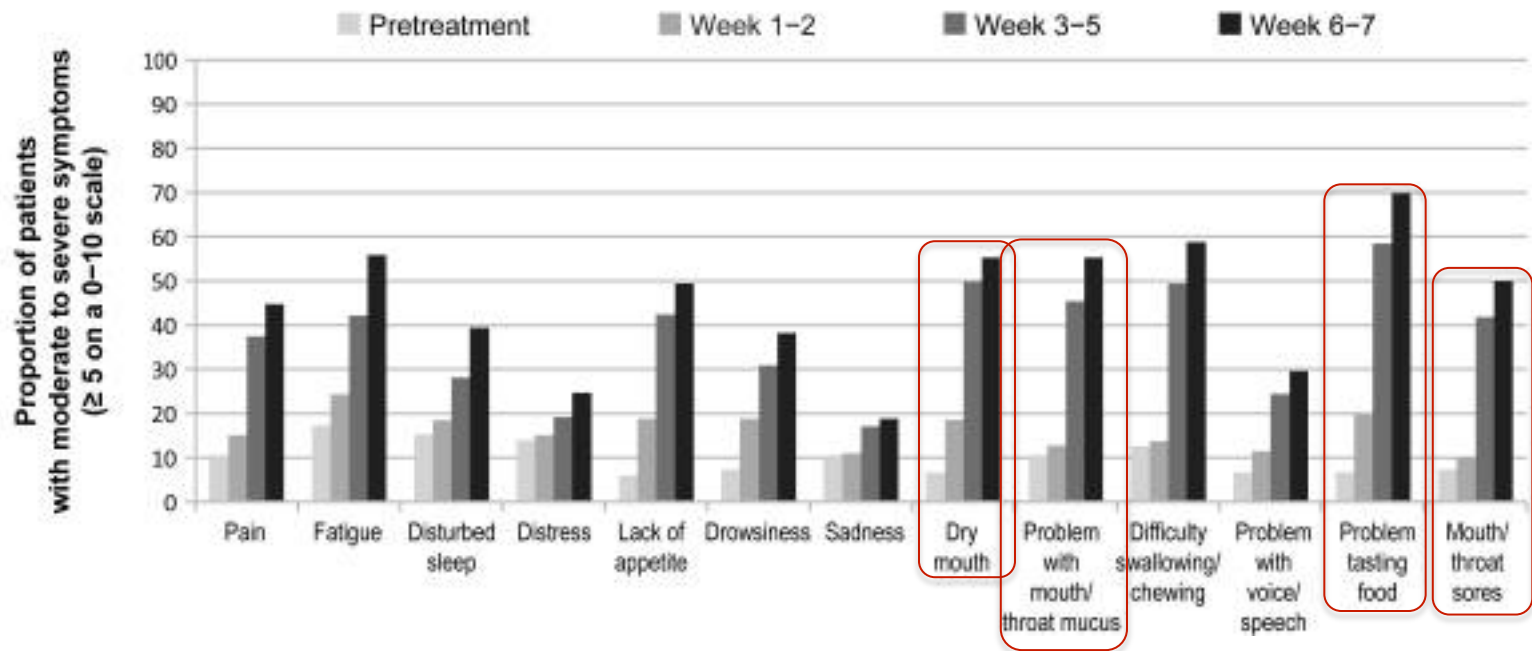
- Systemic Therapy
- Radiosensitizer
 - Neoadjuvant (induction)
 - Concurrent (concomitant)
 - Adjuvant (post-op)
 - Palliative

Acute Toxicities

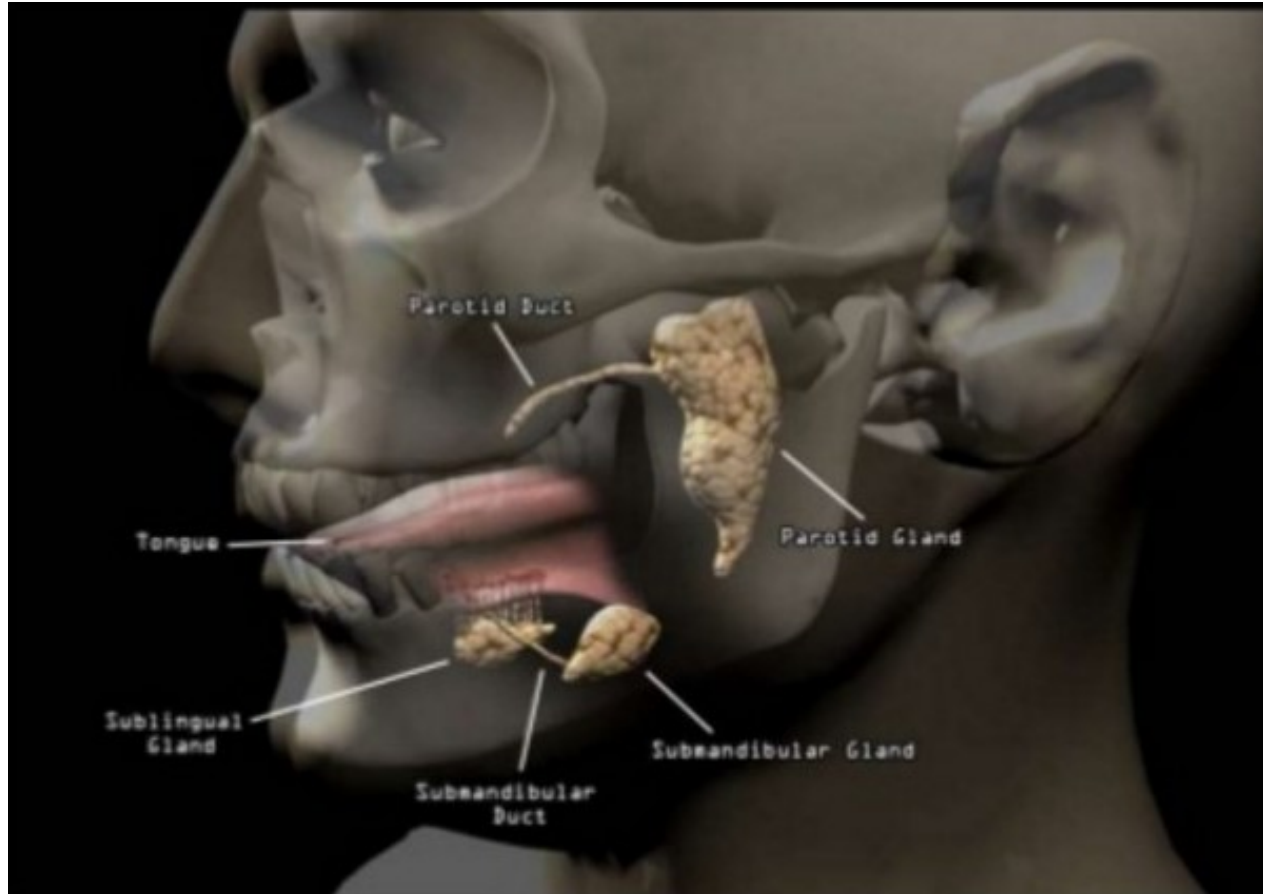


Rosenthal et al. (2014) Patterns of Symptom Burden during Radiation Therapy or Concurrent Chemoradiation.... *Cancer*



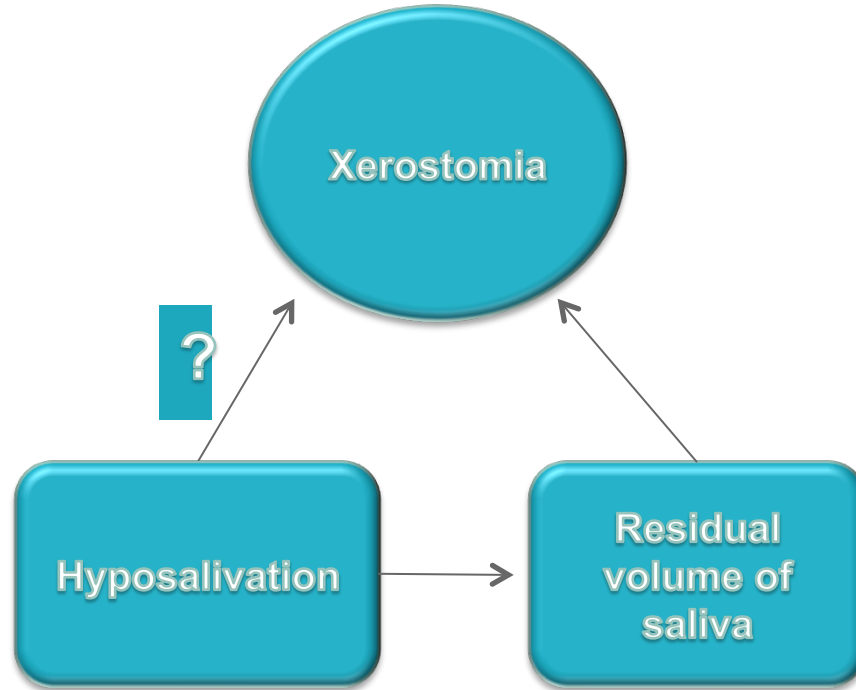


Xerostomia – what happened to my saliva?



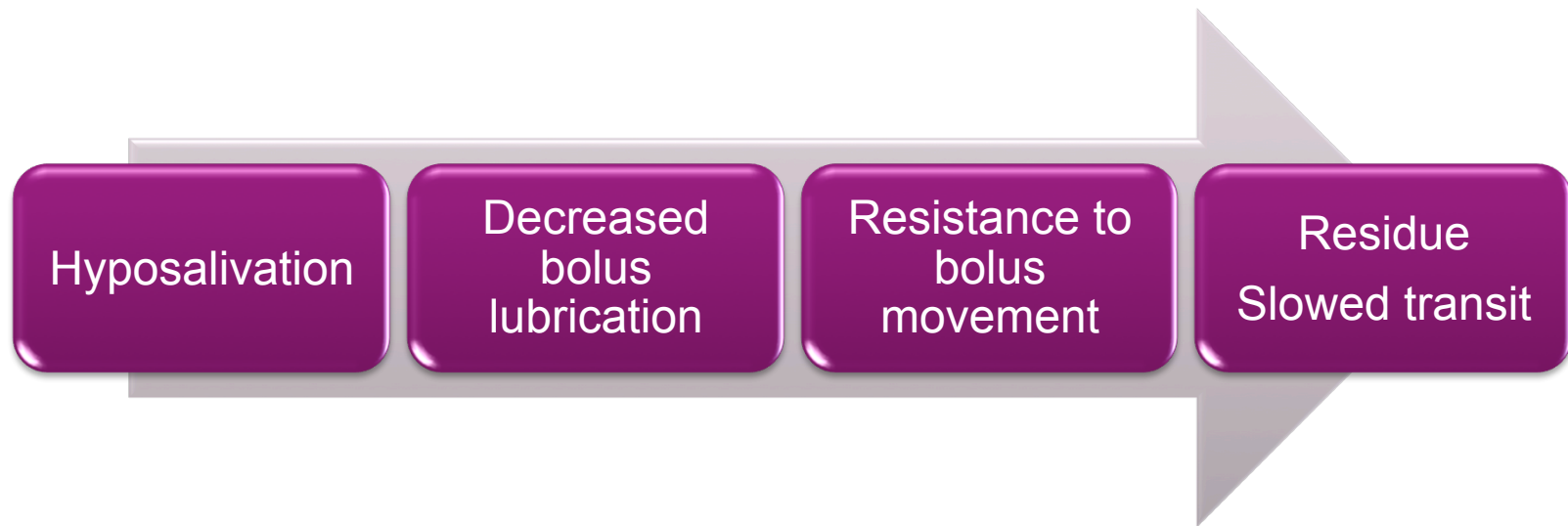
Defining Xerostomia

- **Xerostomia:** the perception of dry mouth (Nederfors, 2000)
- **Hyposalivation:** a measured decrease in amount of saliva produced



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Hyposalivation and Swallowing



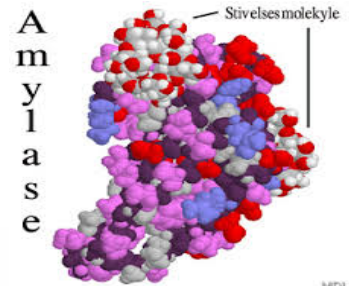
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Changes in Salivary Composition after Radiation

- Saliva becomes ropery, thick, & tenacious (Bruce, 2004, Dirix et al., 2006)
- Disproportionate effect of radiation on serous glands
- Changes in salivary components after radiation (Almstahl et al., 2001; de Barros Pontes et al., 2004):
 - Decrease in mucoglycoproteins
 - Decrease in total protein
 - Decrease in amylase



Perceived Swallowing Effort

EATING ASSESSMENT TOOL (EAT-10)

Date: _____

Name: _____

Height: _____

Please briefly describe your swallowing problem.

Please list any swallowing tests you have had, including when you had them.

To what extent are the following scenarios problematic for you?

Circle the appropriate response	0 = Not at all
1. My swallowing problem has caused me to lose weight.	0
2. My swallowing problem interferes with my ability to go out for meals.	0
3. Swallowing liquids takes extra effort.	0
4. Swallowing solids takes extra effort.	0
5. Swallowing pills takes extra effort.	0

The M.D. Anderson Dysphagia Inventory

This questionnaire asks for your views about your swallowing ability. This information will help us understand how you feel about swallowing.

The following statements have been made by people who have problems with their swallowing. Some of the statements may apply to you.

Please read each statement and circle the response which best reflects your experience in the past week.

My swallowing ability limits my day-to-day activities.
Strongly Agree Agree No Opinion Disagree Strongly Disagree

E2. I am embarrassed by my eating habits.
Strongly Agree Agree No Opinion Disagree Strongly Disagree

F1. People have difficulty cooking for me.
Strongly Agree Agree No Opinion Disagree Strongly Disagree

P2. Swallowing is more difficult at the end of the day.
Strongly Agree Agree No Opinion Disagree Strongly Disagree

*E7. I do not feel self-conscious when I eat.
Strongly Agree Agree No Opinion Disagree Strongly Disagree

E4. I am upset by my swallowing problem.
Strongly Agree Agree No Opinion Disagree Strongly Disagree

P6. Swallowing takes great effort.
Strongly Agree Agree No Opinion Disagree Strongly Disagree



Salivary Viscosity



- Salivary viscosity higher following radiation (Pinna et al., 2011)
- Salivary viscoelasticity increases with age (Zussman et al., 2007)
- Higher salivary viscoelasticity → poor oral health and less co-aggregation of bacteria

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Saliva substitutes and lubricants

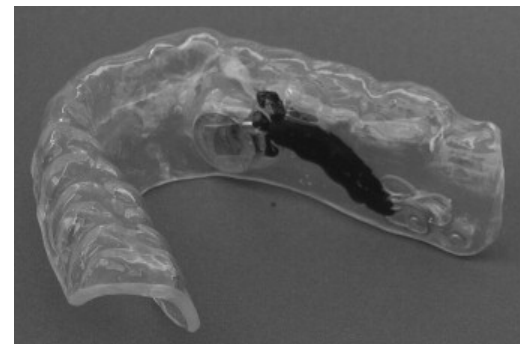


- Commercially available products
 - Contain carboxymethylcellulose or other lubricants-form a slippery film on tissues
 - Various forms: gels, sprays, toothpaste, rinses
 - Examples:
 - Oral Balance
 - Biotene
 - Saliva Orthana
 - Mouth Kote
 - Salivart spray
 - Caphosol
- Papain (enzyme in fruit of papaya plant: tablets or Goya juice)- treat viscous saliva



Other options

- Drugs- Pilocarpine hydrochloride (Salagen); Interferon-alfa lozenges (Cummins et al., 2003)
- Acupuncture- improvement in xerostomia ratings but not salivary flow rate (Simcock et al., 2012)
- Dietary modifications- soft, moist food; papaya juice
- Intraoral electrostimulator (Alajbeg et al., 2012)
- Salivary gland transfer for irradiated patients

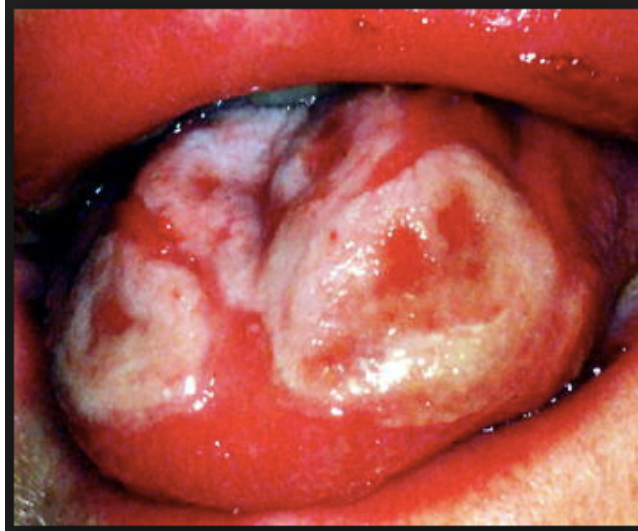


Dysgeusia

- Impaired taste
 - Common – directly associated with RT dose and volume of tongue within the radiated field
 - Partially (mostly?) recovers over time
 - Directly impacts oral intake

Odynophagia

- Painful swallowing
 - Typically associated with oral and/or pharyngeal mucositis



Mucositis

- Inflammation and ulceration





1=MILD PAIN



2=MODERATE PAIN



3=SEVERE PAIN



4= LIFE
THREATENING PAIN

Mucositis Grading Scales

CTCAE version 4.03: Common Terminology Criteria for Adverse Events

Grade

Description	1	2	3	4	5
	Asymptomatic or mild; intervention not indicated	Moderate pain; not interfering with oral intake; mod diet indicated	Severe pain; interfering with oral intake	Life-threatening; urgent intervention indicated	Death

WHO: World Health Organization

Description	0 (none) None	I (mild) Oral soreness, erythema	II (moderate) Oral erythema, ulcers, solid diet tolerated	III (severe) Oral ulcers, liquid diet only	IV (life-threatening) Oral alimentation impossible
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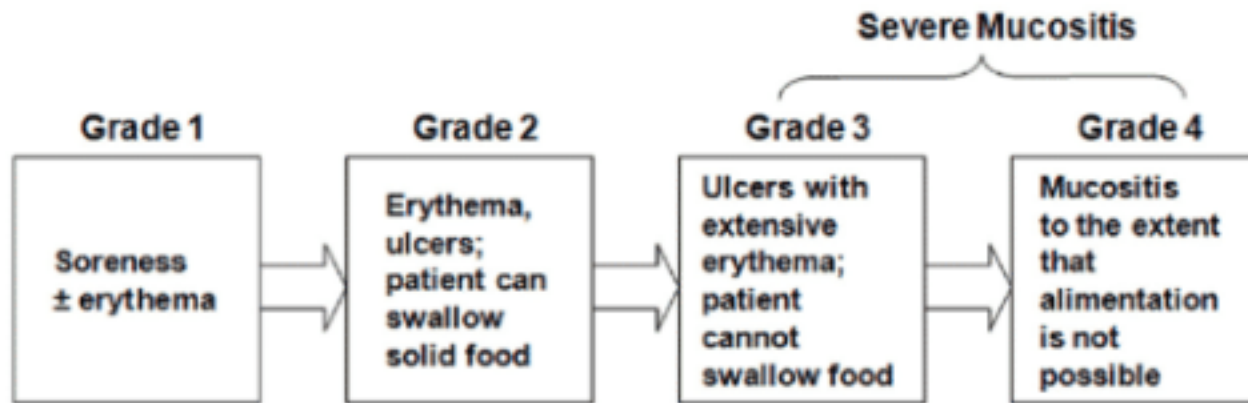
Mucositis

Table 3: Scales Used to Assess OM

	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
WHO	None	Soreness with erythema	Erythema, ulcers, can eat solids	Ulcers, liquid diet only	Alimentation not possible
RTOG	None	Erythema of mucosa	Patchy reaction <1.5 cm, noncontiguous	Confluent reaction >1.5 cm, contiguous	Necrosis or deep ulceration, ± bleeding
NCI CTC	None	Painless ulcers, erythema, or mild soreness in absence of lesions	Painful erythema, edema, or ulcers, but can eat/swallow	Painful erythema, edema, or ulcers requiring IV hydration	Severe ulcerations or requires parenteral/enteral nutritional support or prophylactic intubation
OMAS	Normal	Not severe	Severe	NA	NA
Ulceration/erythema	Normal	<1 sq cm	1-3 sq cm	>3 sq cm	NA

OM: oral mucositis; WHO: World Health Organization; RTOG: Radiation Therapy Oncology Group; ± with or without; NCI CTC: National Cancer Institute Common Toxicity Criteria; NA: not applicable.
Source: References 8-10, 12.

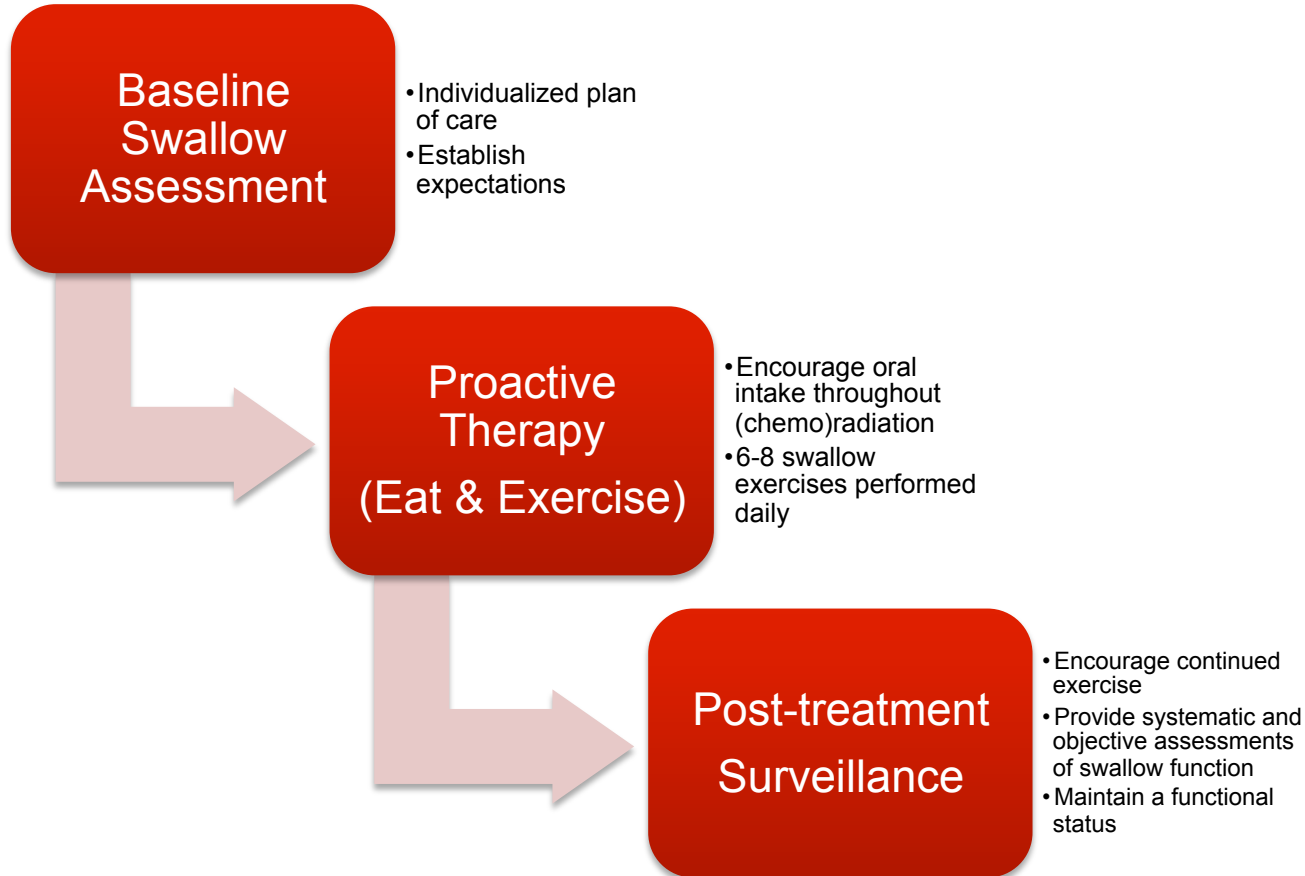
World Health Organization's Oral Toxicity Scale



Tissue Changes from xRT

- Acute phase of injury, structures within the radiation field become **edematous**.
- As vascular changes progress there is a loss of muscle fibers, decrease in fiber size, necrosis, and stiffening of muscles (i.e., **fibrosis**).
- These changes adversely impact the neuromuscular structures involved in swallowing, resulting in **radiation-associated dysphagia (RAD)**.
- Further progression of the neuromuscular insult can result in **persistent dysphagia or even late-RAD**, which can first present or progress substantially decades after radiotherapy; 35-40% incidence.
- **Late-RAD** is typically observed after the delayed onset of mono or polyneuropathies of the lower cranial nerves resulting in profound impairment; <10% incidence.

Framework for non-surgical patients



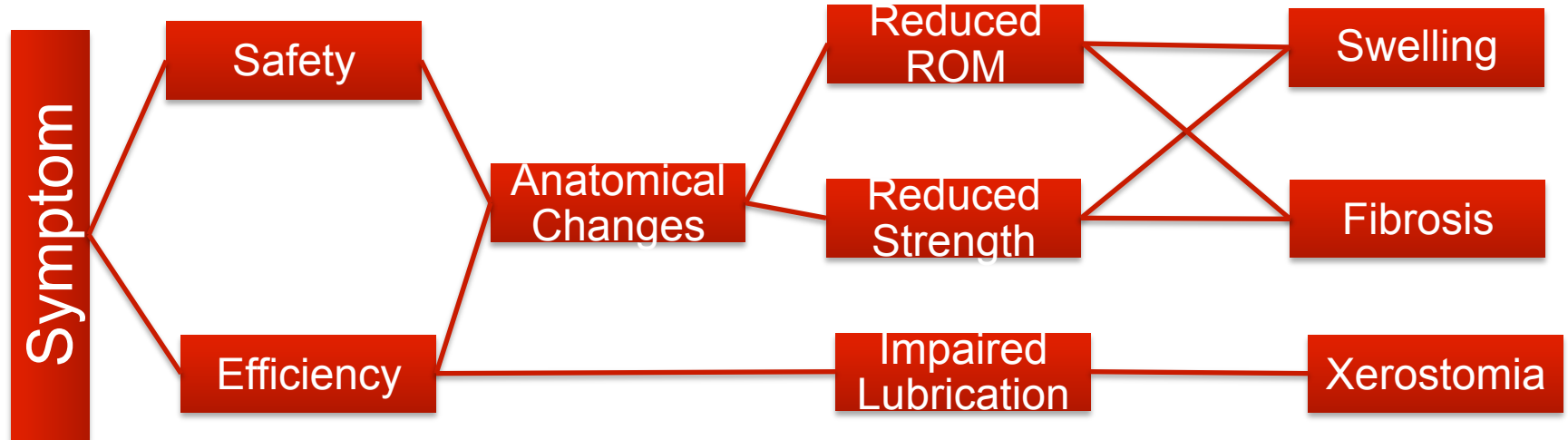
PREVENTION VS MAINTENANCE VS REHABILITATION

- Neuromuscular effects of treatment: edema; scarring; fibrosis
- Proactive/early intervention improves long-term outcomes.
- Rehab – persistent dysphagia: biofeedback, bolus- and device-driven therapies.
- Maintenance: required with non-surgical therapies (xRT and CRT)

THERAPEUTIC EXPECTATIONS

- Impairment based on peripheral damage
- Surgery vs. 'organ sparing'
- Multimodality therapies are common; 80% receive xRT
- 39-64% have chronic deficits following CRT
- Determine Rehabilitation vs. Maintenance
- Patient Goals

Head and Neck Specific Consideration

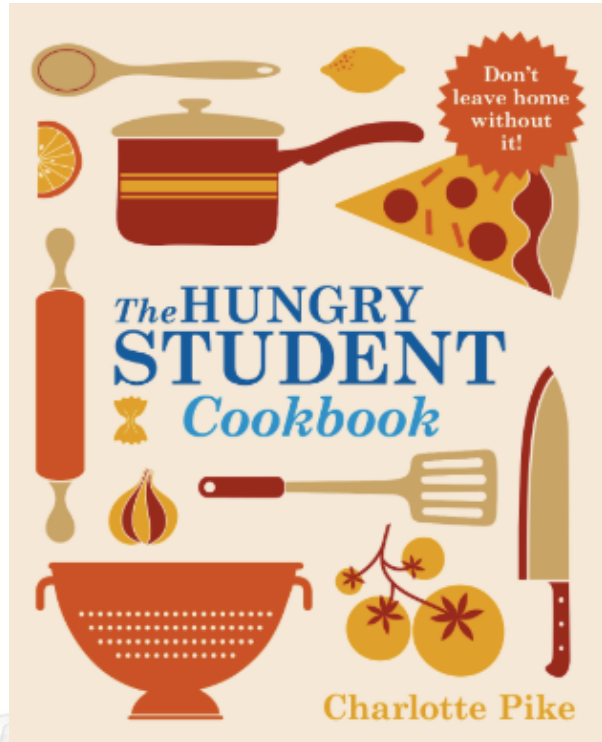


Case Studies

Surgical Intervention



Post-op Consideration



- The next several slides are not meant to provide “cookbook therapy” but instead designed to highlight the predictive nature of surgical intervention.

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Lip



Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none">• Manual lip closure• Head tilt to non-affected side• Utensil modifications• Bolus delivery modifications	<ul style="list-style-type: none">• Labial range of motion exercises• Labial strengthening exercises

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Floor Of Mouth (FOM)



Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none">• Head tilt to non-affected side• Effortful swallow• Liquid assist and/or liquid wash• Utensil modifications• Bolus delivery modifications	<ul style="list-style-type: none">• Lingual range of motion exercises• Lingual strengthening exercises• With sacrifice of <u>hyolaryngeal</u> elevator musculature:<ul style="list-style-type: none">○ Mendelsohn Maneuver○ Effortful pitch glides○ Shaker Technique (Isometric and isokinetic)

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Oral Tongue



Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none">• Head tilt to non-affected side• Posterior head tilt• Palatal drop/augmentation prosthesis• Utensil modifications• Bolus delivery modifications	<ul style="list-style-type: none">• Lingual range of motion exercises of remnant tongue to prevent scarring/tethering of the surgical site• Lingual strengthening exercises of remnant tongue

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Mandible



Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none">• Utensil modifications• Reduced bolus amount	<ul style="list-style-type: none">• Jaw range of motion exercises

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Maxilla



Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none">• Use of <u>obturator</u> device• Head tilt to non-affected side and/or posterior head tilt	<ul style="list-style-type: none">• Not applicable

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Retromolar Trigone



Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none">• Head tilt to non-affected side• Utensil modifications• Reduced bolus amount• Liquid assist and/or liquid wash	<ul style="list-style-type: none">• Jaw range of motion exercises

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Oropharynx



Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none"> • Head turn to affected side • Chin tuck • Volitional oral hold 	<ul style="list-style-type: none"> • Effortful swallow (should formation of scarring post-operatively be anticipated)

Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none"> • Head turn to affected side • Chin tuck • Chin tuck in combination with head turn to affected side • Effortful swallow • Volitional oral hold • <u>Supraglottic Swallow</u> Maneuver 	<ul style="list-style-type: none"> • Masako Maneuver • Effortful Swallow • Lingual range of motion exercises • Oral tongue strengthening exercises

Pharyngeal Wall Cancer



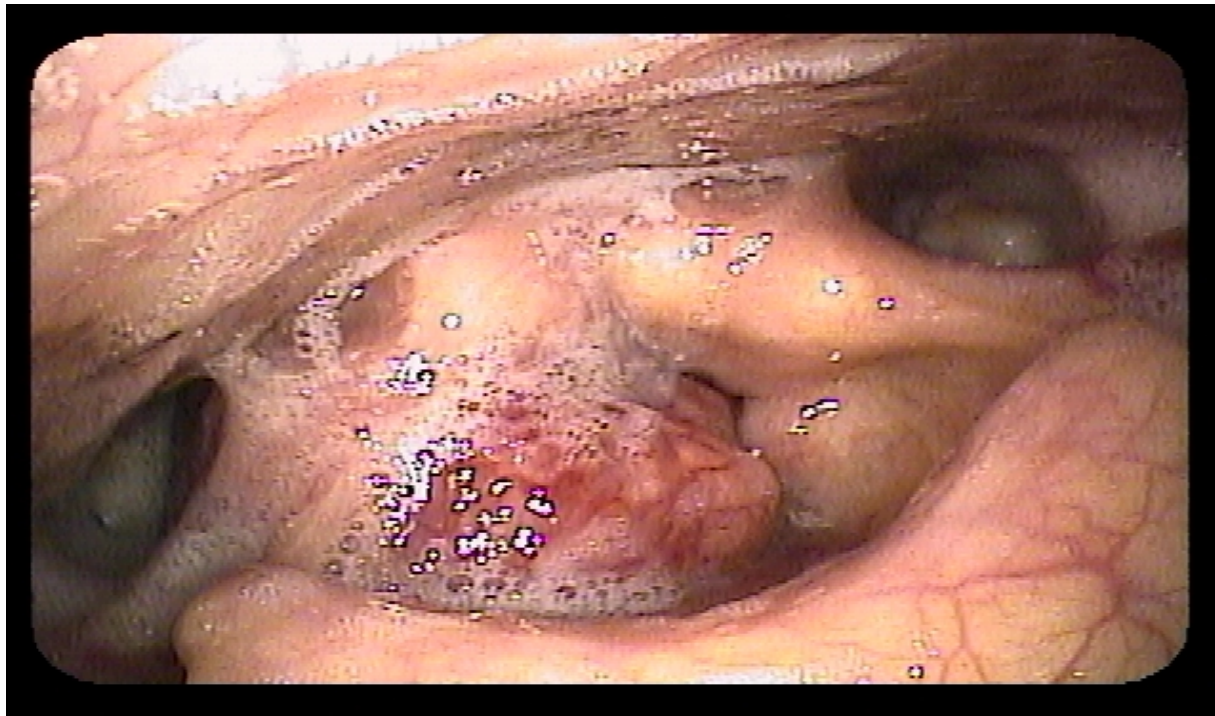
Compensatory Strategies	Rehabilitative Considerations
<ul style="list-style-type: none">• Head turn to affected side• Effortful swallow• Multiple swallows• <u>Supraglottic</u> Swallow Maneuver	<ul style="list-style-type: none">• Masako Maneuver• Effortful Swallow• Mendelsohn Maneuver• Effortful pitch glides• Shaker Technique (Isometric and isokinetic)

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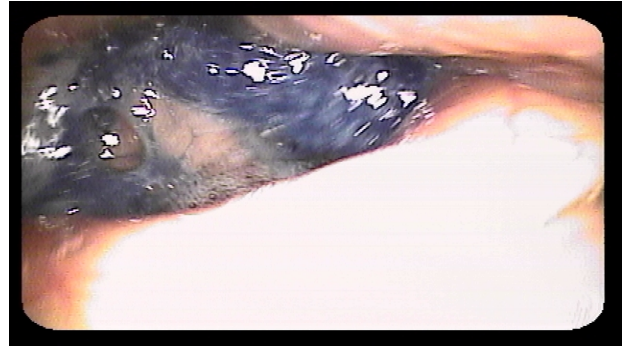
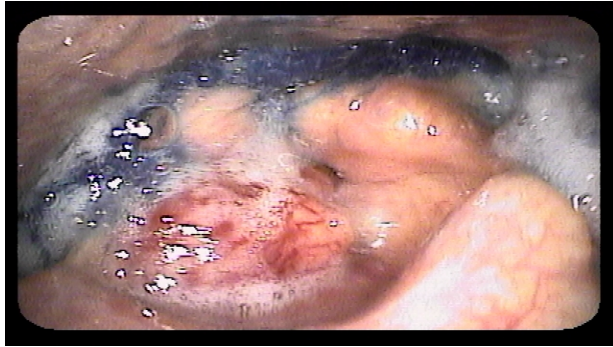
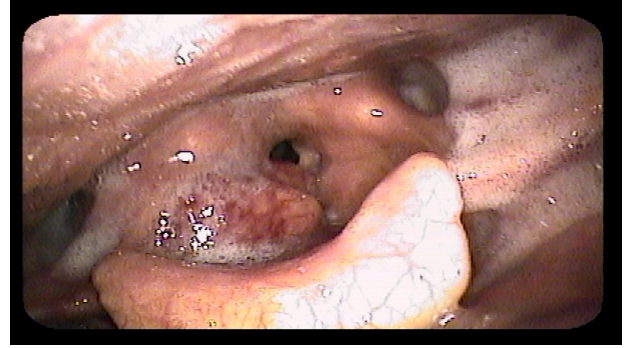
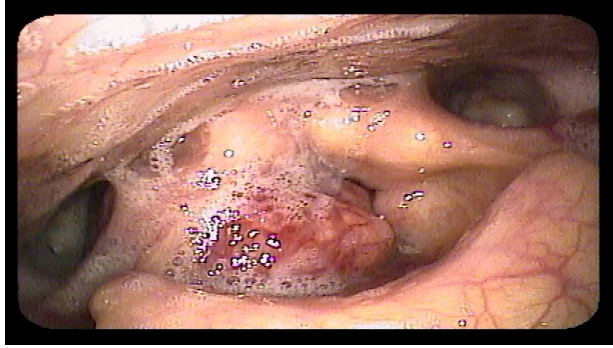
Laryngeal Cancer



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Total Laryngectomy: Patient Education and Counseling

- Anatomical Changes
- Speech Options
- Swallow Function

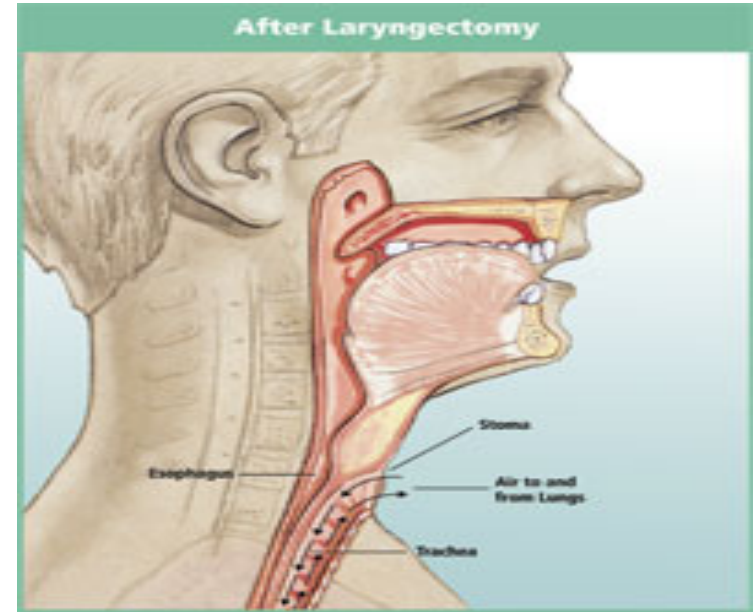
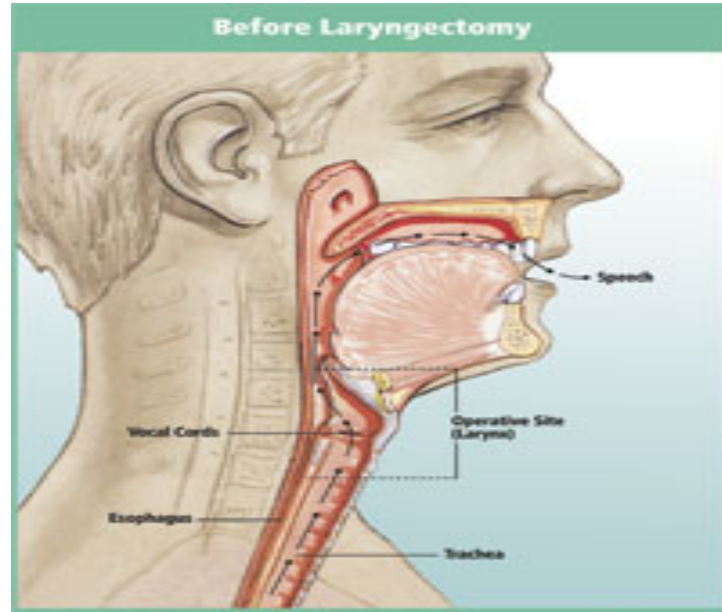
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Anatomical Changes

<http://www.inhealth.com/voicerestorationwhatsalary.htm>



Anatomical Changes

- Permanent tracheostoma - ~ size of the trachea

 - No longer breathing out of your mouth or nose

 - Neck breather only

 - Can't valve to hold your breath – no swimming

 - May have difficulty with heavy lifting

- Removal of voice box/sound source

- Neo-Pharynx opens into the esophagus

 - No way to aspirate

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Alaryngeal Speech Options

- Sound source is gone!
- Power and filter are separated
- What needs to happen?
 - New source with power and flow through filter

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Methods of Alaryngeal Speech

1. Artificial Larynx/Electrolarynx
2. Esophageal Speech
3. Tracheoesophageal (TE) Speech

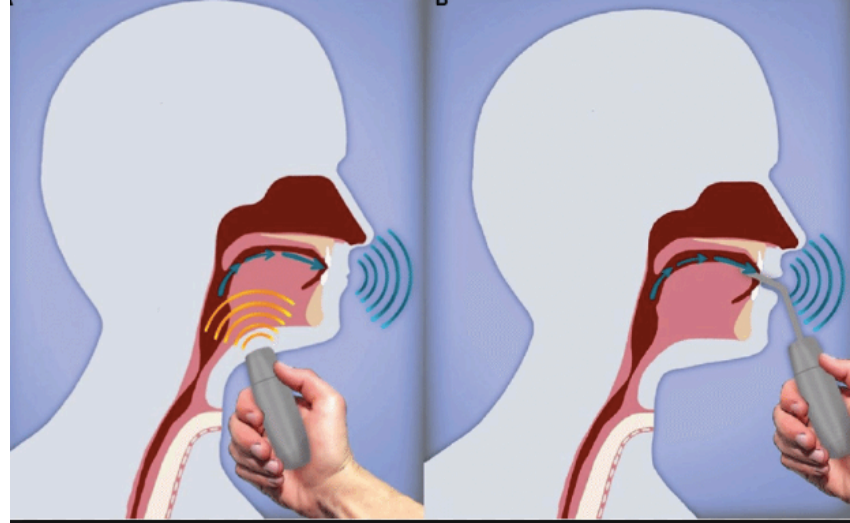
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Electrolarynx – Basic Concepts

- Placement, Seal
 - “Sweet Spot”
- Articulation
 - Intra-oral whispers
- Timing
 - On/Off button control
 - Reduced speech rate
- Volume/Intensity ?
- Pitch ?



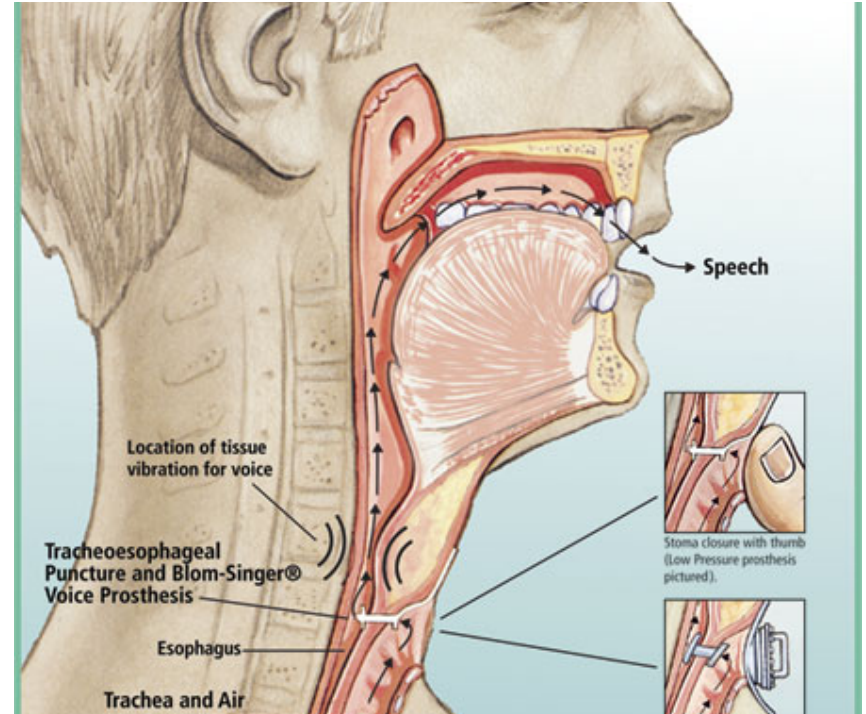
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Tracheoesophageal Speech

- Tracheoesophageal Fistula
 - Allows airflow from lungs into the neopharynx
 - Air flow/pressure → vibration
 - Vibration → sound
 - Sound → shaped into speech



Case Studies

