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Communication Rehabilitation with People Treated for Oral Cancer

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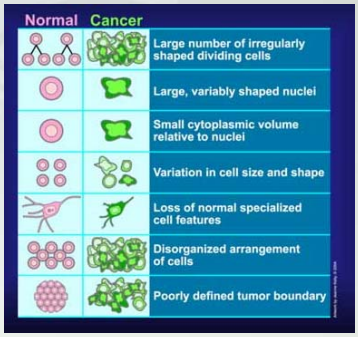
Cancer ↔ malignant growth

- Characteristics
  - Cell growth that is
    - Ongoing
    - Purposeless
    - Unwanted
    - Uncontrolled
    - Damaging
  - Cells that
    - Differ structurally
    - Differ functionally



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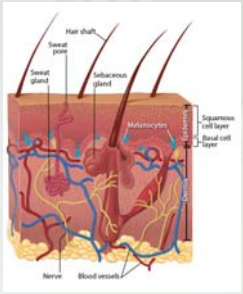
Several types of cancer

Squamous cell = we see most often in oral cavity



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Formation of Cancer

- **NORMAL**: Genes in DNA = controlled division, growth, and cell death
- **CANCER**
  - Genetic control lost or abnormal
  - Abnormal cell divides again and again
  - Mass of unwanted, dividing cells continues to grow
  - potential damage other cells/tissues in body
  - Controls that stop continued division lost/impaired

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Anatomy
Regions for designating cancer location

- Following six slides have images from

International Agency for Research on Cancer (IARC)

Retrieved 05/28/2017 from http://screening.iarc.fr/atlasoral.php?lang=1

Trivandrum Oral Cancer Screening Project.

"A digital manual for the early diagnosis of oral neoplasia."

IARC link to Trivandrum screening

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Lip & Oral Cavity Anatomy Review
Regions for designating cancer location

Lip (vermilion) =

reddish hued area,

Labial mucosa =

thin(ner) lining of the inside of the lips

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Lip & Oral Cavity Anatomy Review
Regions for designating cancer location

Buccal mucosa = lining of cheeks.

Stensen duct opening

Gingiva = tissue covering the neck of the teeth And alveolar ridge.

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Lip & Oral Cavity Anatomy Review
Regions for designating cancer location

Alveolar ridge =
bony ridge that holds the teeth

Retromolar trigone=
small triangular area behind
the last lower molar on each side.

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Lip & Oral Cavity Anatomy Review
Regions for designating cancer location

Anterior 2/3 of tongue =
mobile portion of tongue

Filiform papillae = many, fine, pointed, cone shaped, (blue arrow)

Fungigorm papillae = mushroom-shaped, reddish, dorsum of tongue, (yellow arrow)

Circumvallate papillae = nodular appearing, posterior 1/3 of tongue, (#8-10)

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Lip & Oral Cavity Anatomy Review
Regions for designating cancer location

foliate papillae =
leaf shaped, where side of tongue meets palatoglossal fold, minor salivary glands, lymphoid follicles

Ventral tongue surface = yellow arrow

Median lingual frenum = white arrow

Wharton duct opening = blue arrow

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Lip & Oral Cavity Anatomy Review
Regions for designating cancer location

Floor of mouth = horsehoe-shaped, between ventrum of tongue and gingivae of mandibular teeth, extends to palatoglossal folds posteriorly

Hard palate = roof of oral cavity, contiguous with alveolar ridge of the maxilla and with the soft palate

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Practice Time

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Head & Neck Cancer by the Numbers

Incidence? Cases in a population
- **Incidence rate**: new cases within specified period of time
- **Incidence proportion**: proportion of initially disease free population that develops the disease

Prevalence? actual number of people alive with the disease
- **Period Prevalence**: during a particular period of time
- **Point Prevalence**: at a particular date in time

Mortality? # deaths in certain time period within a certain population

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Oral Cancer Incidence Rate Data

- Worldwide: 405,000 new case per year
  Highest rates: Sri Lanka, India, Pakistan, Bangladesh, Hungary, France
- United States: 53,000

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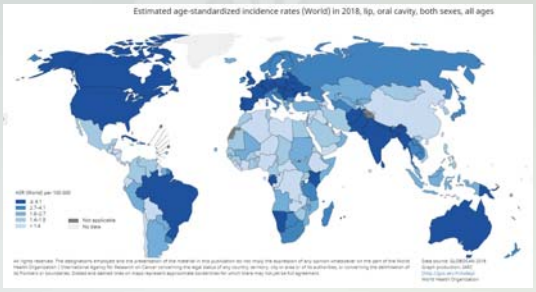
IARC Lip, Oral Cavity Worldwide Incidence Rates



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Oral Cancer stats for the USA

SEER is a good place to look for all kinds of data for the USA

(Surveillance, Epidemiology and End-Results Program)

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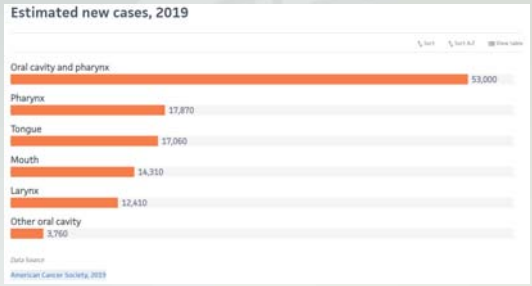
Oral Cancer – USA incidence



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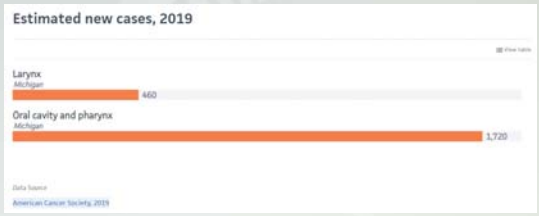
Oral Cancer – MI incidence



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- AND OTHERS
- DevCan – National Cancer Institute
- Head and Neck Cancer Alliance: http://www.headandneck.org/site/c.8hKNI0MEImI4E/b.6281225/k.BDD9/Home.htm
- Support for People with Oral and Head and Neck Cancer: http://www.spohnc.org/

Selections:
Year = 2013-2015;
Race = All Races;
Sex = Both Sexes;
Starting Age = 0;
Ending Age = 95+;

Results:

Probability of Developing Cancer

Oral Cavity and Pharynx -- Mal only	1.15%
Lip -- Mal only	0.08%
Tongue -- Mal only	0.36%
Floor of Mouth -- Mal only	0.05%
Gum and Other Mouth -- Mal only	0.17%
Oropharynx and Tonsil -- Mal only	0.25%

Probability of Dying of Cancer

Oral Cavity and Pharynx -- Mal only	0.30%
Lip -- Mal only	0.00%
Tongue -- Mal only	0.08%
Floor of Mouth -- Mal only	0.00%
Gum and Other Mouth -- Mal only	0.05%
Oropharynx and Tonsil -- Mal only	0.05%

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Currently in the US – some general conclusions for Oral Cavity and Pharynx cancers

- Men 2x > Women
- Death rates declining 1%-2% past decade
- Survival deteriorates moving from lips to larynx
- 10%-15% have other head & neck tumors

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Increasing Incidence of HNSCC

Increased incidence of **some types** of oral, head and neck squamous cell carcinoma over the last 3 decades.

Despite decreasing smoking rates

Base of tongue, tonsil in particular – and particularly for white men

Head Neck Oncol. 2009 Oct 14;1:36. www.headandneckoncology.org/content/1/1/36

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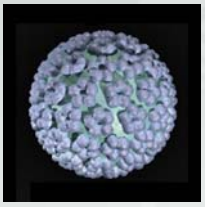
Primary reason for this increase - HPV



- Very common virus
- 50% sexually active adults with HPV infection in their lifetime
- >130 strains or genotypes
- Most of these strains are harmless, treatable, and or noncancerous

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HPV – Oral Cancer

- Fastest growing oral and oropharyngeal cancer population
  - Otherwise healthy
  - Non-smoking
  - 35-55 years old
  - More males than females (4:1)
  - HPV usually manifests in oropharynx, but also for more anterior oral sites

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Sexual Transmission of HPV

- behavioral epidemiologists → changing sexual behaviors in the 1960s led to increased HPV exposure.
- Several studies = oral HPV infection is likely to be sexually acquired.

  E.g., D'Souza and colleagues found that a high (26 or more) number of lifetime vaginal-sex partners and 6 or more lifetime oral-sex partners were associated with an increased risk of HNSCC

D'Souza et. al. N. Engl J Med 2007 May 10; 356(19): 1944-56

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Etiologic agents and risk factors

Tobacco Products:
- Smoking Tobacco
- Cigarettes
- Cigars
- Pipes
- Chewing Tobacco
- Snuff

Ethanol Products

Laryngopharyngeal Reflux

Chemicals:
- Asbestos
- Chromium
- Nickel
- Arsenic
- Formaldehyde

Other Factors:
- Ionizing Radiation
- Epstein-Barr Virus
- Human Papilloma Virus

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E-cigarettes


SPECIAL ISSUE ARTICLE

WILEY

Electronic nicotine delivery systems: Oral health implications and oral cancer risk

Ahmed S. Sultan[1] | Maryam Jessri[2] | Camile S. Farah[2]

- 2014 FDA Regulations applied – relative sales to minors; only nicotine containing liquids
- 2017 National Youth Tobacco Survey
  - Middle school – 3% in last 30 days
  - High School – 11.7% in last 30 days
- Health risk studies – few
- The liquids keep changing
- NEJM (2015) and FDA – formaldehyde in vapor; other carcinogens
- Vitamin vaping!?

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And more

- Genetic factors
- Sun exposure (lips)
- Wind exposure (lips)
- Diet low in fruits and veggies
- Areca nut, betel nut, betel leaf; paan, pan masal, supari

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Reminder of synergistic impact of smoking and drinking

- Doing both is worse than doing either one individually
- Most who smoke also drink alcohol (reverse not true)
- OR of heavy drinking + heavy smoking significantly increased vs either behavior alone

CDC definition of 'heavy drinking': Men = 15/week, Women = 8/week

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Staging & Surgical-Oncological Tx

- Clinical guidelines available – based heavily on
  - Size, local spread, distant spread (i.e., staging)
  - Patient wishes
  - Comorbidities
- Briefly… staging

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Staging

- Clinical vs. pathologic (surgical)
- American Joint Committee on Cancer (AJCC)
- Stage 0, I, II, III, IVA, IVB, IVC
- AJCC for Lip, Oral Cavity, p16 neg OP Cancer
  - **T – primary tumor size**
  - **N – lymph node spread**
  - **M – distant spread**

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AJCC Staging for Lip & Oral Cavity: T

LIP AND ORAL CAVITY STAGING FORM

CLINICAL *Extent of disease before any treatment*	STAGE CATEGORY DEFINITIONS	PATHOLOGIC *Extent of disease during and from surgery*
❑ y clinical– staging completed after neoadjuvant therapy but before subsequent surgery	TUMOR SIZE: _____ LATERALITY: ☐ left ☐ right ☐ bilateral	❑ y pathologic – staging completed after neoadjuvant therapy AND subsequent surgery
	PRIMARY TUMOR (T)	
❑ TX	Primary tumor cannot be assessed	❑ TX
❑ T0	No evidence of primary tumor	❑ T0
❑ Tis	Carcinoma *in situ*	❑ Tis
❑ T1	Tumor 2 cm or less in greatest dimension	❑ T1
❑ T2	Tumor more than 2 cm but not more than 4 cm in greatest dimension	❑ T2
❑ T3	Tumor more than 4 cm in greatest dimension	❑ T3
❑ T4a	Moderately advanced local disease. (lip) Tumor invades through cortical bone, inferior alveolar nerve, floor of mouth, or skin of face, i.e., chin or nose (oral cavity) Tumor invades adjacent structures only (e.g., through cortical bone, [mandible or maxilla] into deep [extrinsic] muscle of tongue [genioglossus, hyoglossus, palatoglossus, and styloglossus], maxillary sinus, skin of face)	❑ T4a
❑ T4b	T4b Very advanced local disease. Tumor invades masticator space, pterygoid plates, or skull base and/or encases internal carotid artery	❑ T4b
	Note: Superficial erosion alone of bone/tooth socket by gingival primary is not sufficient to classify a tumor as T4.	

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AJCC Staging for Lip & Oral Cavity: N and M

	REGIONAL LYMPH NODES (N)	
❑ NX	Regional lymph nodes cannot be assessed	❑ NX
❑ N0	No regional lymph node metastasis	❑ N0
❑ N1	Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension	❑ N1
❑ N2	Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension; or in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension; or in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension	❑ N2
❑ N2a	Metastasis in single ipsilateral lymph node more than 3 cm but not more than 6 cm in greatest dimension	❑ N2a
❑ N2b	Metastasis in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension	❑ N2b
❑ N2c	Metastasis in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension	❑ N2c
❑ N3	Metastasis in a lymph node more than 6 cm in greatest dimension	❑ N3
	DISTANT METASTASIS (M)	
❑ M0	No distant metastasis (no pathologic M0; use clinical M to complete stage group)	
❑ M1	Distant metastasis	❑ M1

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AJCC Staging by TNM

LIP AND ORAL CAVITY STAGING FORM

ANATOMIC STAGE • PROGNOSTIC GROUPS

	CLINICAL				PATHOLOGIC			
	GROUP	T	N	M	GROUP	T	N	M
❑	0	Tis	N0	M0	❑ 0	Tis	N0	M0
❑	I	T1	N0	M0	❑ I	T1	N0	M0
❑	II	T2	N0	M0	❑ II	T2	N0	M0
❑	III	T3	N0	M0	❑ III	T3	N0	M0
		T1	N1	M0		T1	N1	M0
		T2	N1	M0		T2	N1	M0
		T3	N1	M0		T3	N1	M0
❑	IVA	T4a	N0	M0	❑ IVA	T4a	N0	M0
		T4a	N1	M0		T4a	N1	M0
		T1	N2	M0		T1	N2	M0
		T2	N2	M0		T2	N2	M0
		T3	N2	M0		T3	N2	M0
		T4a	N2	M0		T4a	N2	M0
❑	IVB	Any T	N3	M0	❑ IVB	Any T	N3	M0
		T4b	Any N	M0		T4b	Any N	M0
❑	IVC	Any T	Any N	M1	❑ IVC	Any T	Any N	M1
❑	Stage unknown				❑ Stage unknown			

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Surgery, Radiation & Chemotherapy for Oral Cancer

OVERALL Approach

- Surgical resection as 1º
  - Particularly with early stages (T1/T2, N0)
  - +/- reconstruction
  - +/- elective neck dissection; sentinel node biopsy
- Radiotherapy or Chemoradiation as Adjuvant

[Note: Oropharyngeal = more nonsurgical, and minimally invasive surgery]

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Resection - more pics later

- **Removal of tissue**
- Tumor size & location dictates removal volume
- E.g., Tongue
  - Partial (<40%)
  - Hemi (40%-60%)
  - Subtotal (>60% - almost all)
  - Total (100%)

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Reconstruction Ladder - more later

- Healing by secondary intention
- Primary closure
- Skin grafting (split or full thickness)
- Composite grafts
- Locoregional flaps
- Free tissue transfer

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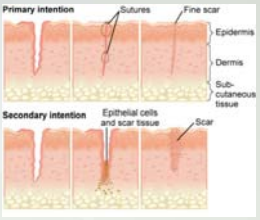
Primary and Secondary Intention



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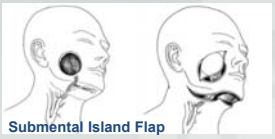
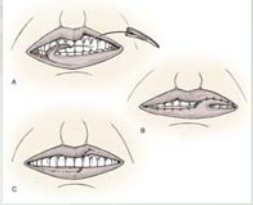
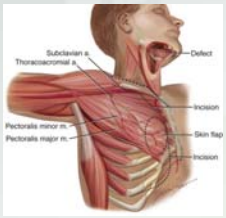
Flaps - local, regional → examples



Submental Island Flap

Pedicle flap (converts to free flap)





Pectoralis Major Myocutaneous Flap

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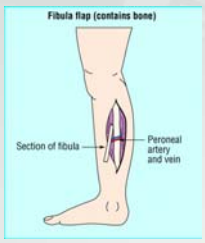
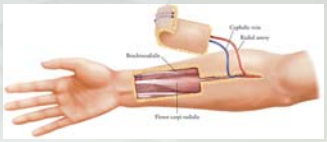
Free Flaps – also various →





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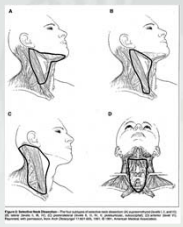
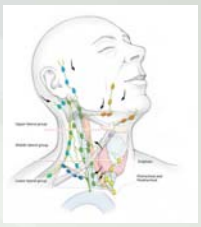
Neck Dissection – also various extents





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Neck Dissection

Elective neck dissection in oral carcinoma: a critical review of the evidence

- >50% pts with OSCC = lymph metastases
- Most important prognostic factor = lymph mets
- 50% reduction in 5yr survival of regional nodes involved
- SO → treating the neck is critical
- Therapeutic – Opportune -- Elective

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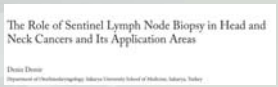
Neck Dissection



The Role of Sentinel Lymph Node Biopsy in Head and Neck Cancers and Its Application Areas

- Treating the person with “N0” neck
- Elective Neck Dissection
  - 3 RCT = advantages for survival
  - Most offer it – stil some controversy
- Sentinel Lymph Node Biopsy

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Radiation Therapy

NCI Resource on Radiation The

- 3 ways to deliver
  - External beam radiation therapy – common for oral
  - Brachytherapy (internal radiation therapy)
  - Systemic radiation
- Mode of impact = damages cell DNA; damaged cells stop dividing or die

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Briefly – external beam

- '**Simulation**'
  - planning
  - Detailed imaging (CT, could be MRI, PET, ultrasound)
- **Mask** - stabilize head
- Computer + MD - determine dose, area of exposure, safest paths of radiation delivery, schedule of treatment intensity/duration

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External beam - delivery

- Various schedules and approaches now
- Historically - 5 days/week for 6-7 weeks
- Other **fractionation** schedules in use
  - Hyperfractionation – smaller dose more than 1x day
  - Hypofractionation – larger dose 1 day or less
  - Accelerated fractionation – larger daily or weekly doses

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Last on external beam

- **IMRT** = intensity-modulated radiation therapy
  - "beam shaping"
  - Varied radiation intensity to different areas/depths
  - Reverse planning
- **3D-CRT** = 3-dimensional conformal radiation therapy
- **IGRT…Tomotherapy…Stereotactic radiosurgery**

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Chemotherapy – briefly

- Drugs - slow or stop growth of cancer cells
- Combo with radiation Tx in head and neck cancer in many instances
  - To make a tumor smaller
  - Destroy cancer cells remaining after XRT or surgery
  - Enhance other treatments
  - Kill cancer cells that recur

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Side Effects – some impacting speech

- Mucositis
- Xerostomia
- Candida, other
- Lymphedema
- Fibrosis

Side Effects – some impacting speech

- Dysgeusia
- Dermatitis
- Dental decay
- osteoradionecrosis




Chemotherapy

Cisplatin – standard treatment for H&N SCC

- Intravenous
- Common side effects
  - Nausea, vomiting
  - Low blood count
  - Renal toxicity
  - **Ototoxicity**
  - Altered blood test results (magn, calcium, potassium)
- Less common side effects: Peripheral neuropathy, Decreased appetite, Taste sensation change, Hair loss

Oral Cancer Impact on Speech

- Cancer impact
- Cancer treatment impact – surgery, radiation

Oral Cancer Impact on Speech

Before any treatment

- N=172 (125M/47F)
- Dx:
  - maxillary alveolar ridge – 9
  - Buccal mucosa – 12
  - Margin tongue – 42
  - Palate – 8
  - Oral floor – 50
  - Mandibular alveolar ridge - 51
- 12% lower Word Recognition (automatic)
- Female>Male (OSCC)
- Age and gender → WR
- Location of tumor mattered

Speech intelligibility in patients with oral cancer: An objective baseline evaluation of pretreatment function and impairment

Florian Stelzle PhD, MD, DMD | Nicolai Oetter MD | Luisa Theresa Goellner | Werner Adler PhD | Maximilian Rohde MD, DMD | Andreas Maier PhD, Dr.-Ing. | Levi Matthies | Marco Rainer Kesting PhD, MD, DMD | Christian Knipfer MD, DMD

Head & Neck. 2019;1-7.

Oral Cancer Impact on Speech

Before any treatment

Controls WR = 75.81 ± 7.15%

Location		
Maxillary alveolar ridge	9	71.71 ± 6.69%
Buccal mucosa	12	71.45 ± 10.80%
Margin of tongue	42	66.31 ± 15.29%
Palate	8	65.40 ± 15.75%
Oral floor	50	62.24 ± 24.37%
Mandibular alveolar ridge	51	60.75 ± 13.72%

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Head & Neck. 2019;1-7.

Oral Cancer Impact on Speech

Before any treatment – self-report

PATIENT DELAY IN ORAL CANCER: A QUALITATIVE STUDY OF PATIENTS' EXPERIENCES

- N=21
- Oral cancers + 1 BOT
- Interviews + thematic analysis
- Detection of Speech Changes?

Change in eating or talking. Many patients noted that they had experienced some interference with function during the development of the disease. Frequently, patients made a point that the pain or discomfort that they experienced as a result of their oral lesion was only experienced during mastication or when they spoke.

> I can't chew. As soon as this started I don't chew, I just swallow. It don't get serious unless I chew. I've got some grandchildren at home and I shout at them—the pain starts. So I've been trying not to chew or shout. (17; no prolonged delay)

p.481

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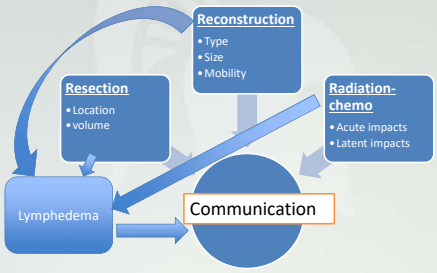
Oral Cancer **Treatment** - Impact on Speech

This is primarily what we deal with.



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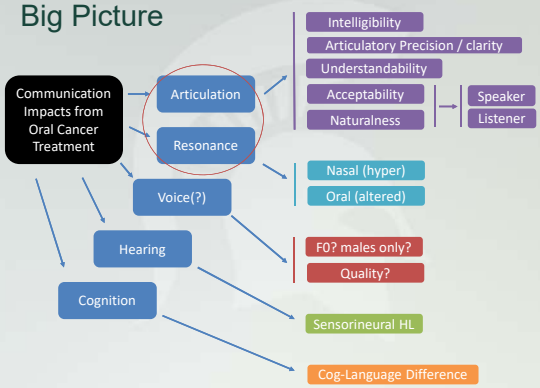
Big Picture



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Subset of tumor locations considered here

- Tongue
- Palate (hard/soft)
- Lips

These 2 cause the most trouble for speech

A few details on each of these with links to speech.

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Tongue

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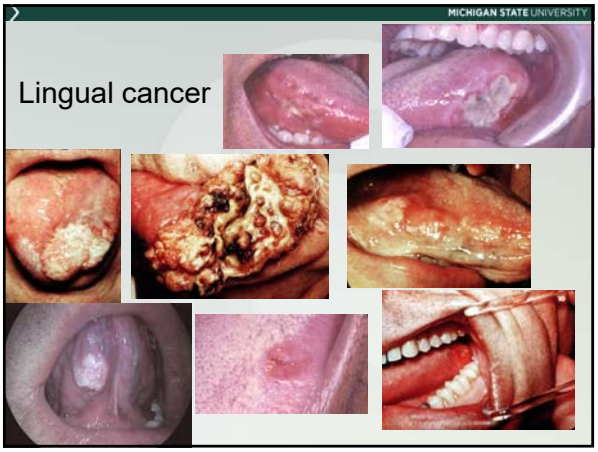
Lingual cancer



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Degrees of Tongue Resection

- **Partial Glossectomy**
- **Hemiglossectomy**
- **Sub-total of Near-total glossectomy**
- **Total glossectomy**

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Partial Glossectomy

Primary closure

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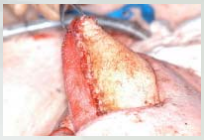
Hemiglossectomy and Near-total Glossectomy

- Free tissue reconstruction usually preferred
  - Can match flap to defect in terms of size/volume
  - Large defects can be filled
  - Possibility for microneurorrhaphy procedure
  - Flap tissue not exposed to XRT



Radial forearm free flap

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Total glossectomy

- Tongue "pull through" technique unless tumor invades mandible
- May require rectus abdominis or anterior lateral thigh flap rather than forearm due to need for increased bulk

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Total glossectomy

Pectoralis flap

Anterolateral thigh flap

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Tongue Cancer Surgery – what changes?

- Mass
- Mobility
- Oral cavity space
  - Volume
  - Contour
- Sensation
- Besides speech
  - Saliva issues
  - Eating/chewing
  - Appearance

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Example: Partial Glossectomy +

Case 1. DH

Age at video = 65
Smoker who quit at 57

Dx with FOM, lingual cancer at 59

TX sequence
1. 48 radiation treatments soon after Dx
2. 5yrs later (age 64) cancer returned aggressively
3. FOM+lingual resection; radial forearm flap
4. Some SLP follow-up for swallow, not speech

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Partial Glossectomy

Case 2.

Female

early 20's

Non-smoker

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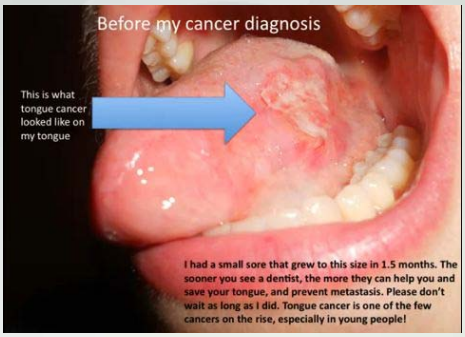
Partial Glossectomy: Case 2



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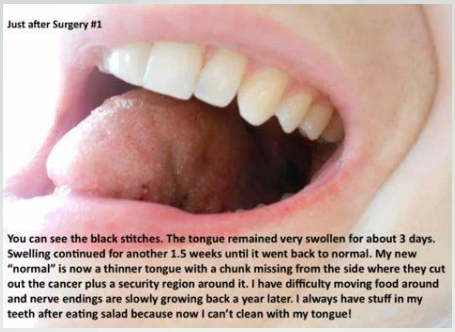
link to immediate post surgery

Partial Glossectomy: Case 2



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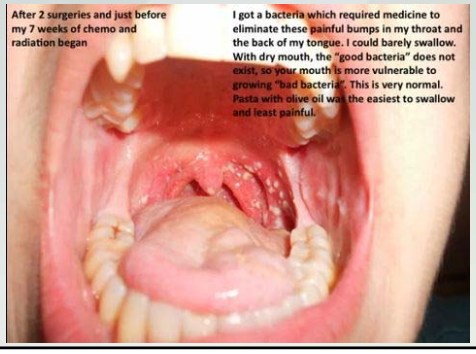
Partial Glossectomy: Case 2



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Partial Glossectomy: Case 2

Catherine's story through radiation

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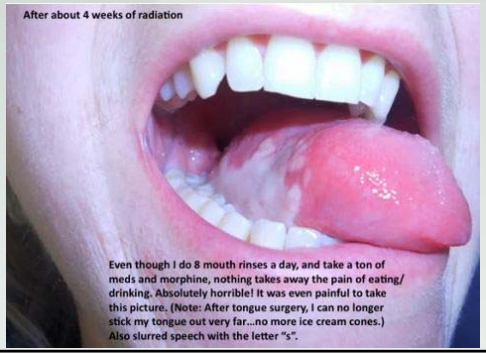
Partial Glossectomy: Case 2



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Partial Glossectomy: Case 2

Chubby cheeks from radiation. Crooked smile from weakened muscle and less flexibility in my neck, but still having fun. Who cares what others think, it's time to do what you haven't done before. It's time to live!

3 months after last radiation

Now, after treatment, I have recessed gums (increased sensitivity). Yes, the side effects they tell you about are very real! I also have dry mouth from 35 days of radiation. One salivary gland was completely removed and the remaining glands got radiated very hard and don't function well now. I carry water everywhere I go. Check out kleenkanteen.com for a good steel bottle!

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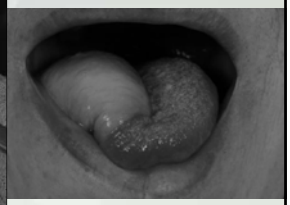
HemiGlossectomy: Robert (w/flap)



Robert at 2 months

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Near-Total glossectomy: Case example

ODE TO THE PRESENT.

This moment as smooth as a board
and fresh
This hour, this day as clean as an
untouched glass.
Not a single spiderweb from the past
We touch the moment with our fingers
We cut it to size, we direct it's blooming
It's living, it's alive, it brings nothing
from yesterday that can't be redeemed
nothing from the lost past. This is our
creation
It's growing this very instant, kicking up
sand
or eating out of our hand.

1 month post

10 month post

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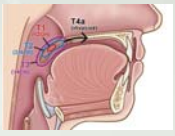
Palatal tumors



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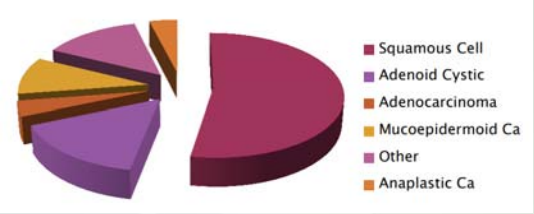
Palatal Malignancies – a bit more variety



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Palatal Cancers

- Not very common
- Soft palate > hard palate
- Soft palate causes – as before
- Hard palate –
  - perhaps as before; reverse smoking; syphilis; irritation from dentures?
  - Often late presentation (months to years)

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Hard Palate Resection

- Approach based on size
  - Small lesion = transoral, partial maxillectomy
  - Larger = partial maxillectomy → lateral rhinotor
  - Large extending through palate
    → total maxillectomy
- Palate is midline structure
  - Neck treated bilaterally –END
- Combo Surgery + XRT for most

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Hard Palate - Obturation

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Hard Palate – Obturation = historical gold standard

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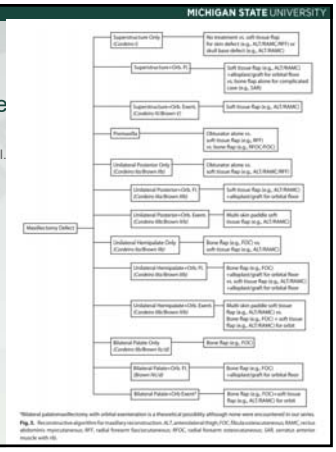
Hard Palate – Reconstruction = ne

- Radial forearm (Jeong et al. 2017)
- Rectus abdominus flap (Ogino, et al., 2019)
- Anterolateral thigh; latissimus dorsi, fibula osteocutaneous, etc. (Hanasono et al., 2012)



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Soft Palate Resection - obturation

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Lip Cancer

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Lip Cancer - Treatment

- Really depends on staging, regional node involvement, distant metastasis
- Often caught early so local excision with no, or minor, reconstruction

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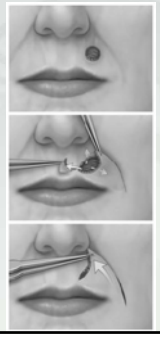
Lip Cancer – surgical examples

Excision with primary closure



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Lip Cancer - surgery

- Lip flap
  - Remove tumor from top lip
  - Raise flap from lower lip
  - Close upper lip defect

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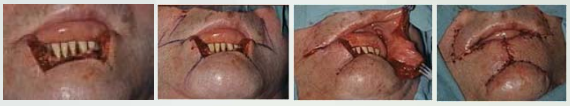
Excision with lip reconstruction



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Lip Cancer: Case Study (all lower lip)

- 40 yr old
- Smoker for 20+ years
- Lip cancer dx at age 38
- Sequence of Tx
  - Radiation (38) and chemo (16)
  - Cancer returned quickly (2 weeks)
  - Resection (lower lip, FOM, jaw) w/ reconstruction (multiple)

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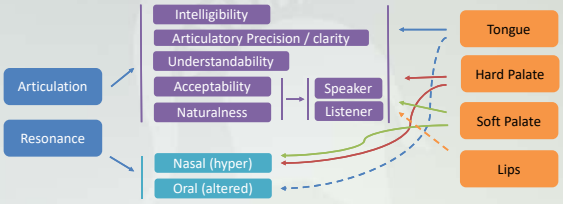
Projected Problems



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The literature? → speech intelligibility

Speech Intelligibility After Glossectomy and Speech Rehabilitation

- N=27
- 3 groups
- Ratings of SI, other measures
- At 6 months post surgery

- "intelligible" after partial (12)
- "partially intelligible" after subtotal (9)
- "intelligible with attention" after total

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Sampling of others regarding SI

	Details	Results
Chien et al. (2006)	39; total & near total; 1 yr post	- 8% = unintelligible - 92% = intelligible - SI task/rating unclear
Carvalho et al. (2008)	36; hemi & near total, wearing palatal augmentation	- 22% = normal SI - 31% = mild impairment - 25% = moderate - 22% = severe - Better with vs w/o pros.
Borggreven et al. (2007)	80; oral and oropharyngeal; 1 yr post; flap recon	- 71% = deviant SI (rating)
Romer et al. (2019)	81; T1/T2 oral SCC, no reconstr	- "excellent" speech outcomes
Steltzle et al. (2013)	71; tongue, FOM, mandib alveolar ridge	- WR at 12 months 28% lower for all vs control
Lee et al. (2014)	63; oral tongue, most T1; partials	- Mean "understandability rating" = 88%

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Oral Oncology

Evaluation of speech outcomes using English version of the Speech Handicap Index in a cohort of head and neck cancer patients

- 17 OC & 38 OPC
- Subsites
  - Tongue 15
  - BOT 15
  - Tonsil 22
  - FOM 2
  - SP 1

- Various stages
- Primary surgery
- All with AV RT/ChemoRT
- 2yr -12 yr follow up
- Speech Handicap Index

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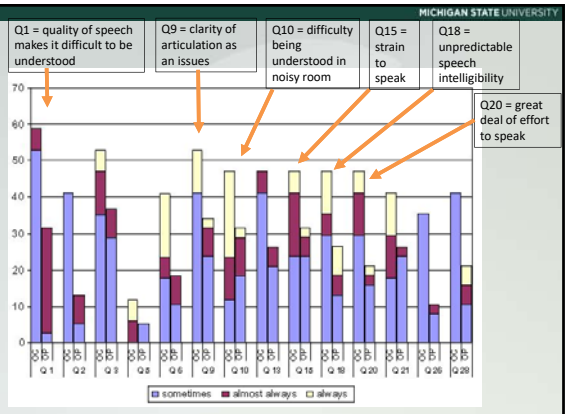

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Dwivedi et al – other findings

- Overall Speech Quality (self-report)
  - OC: 35% good-excellent
    65% ave – poor
  - OPC: 76% good-excel
    24% ave/ - poor
- OC and OPC – speech worse in evening → fatigue

- More severe speech-related psycho-social impairment -OC
  1. Feelings of incompetence bc of speech
  2. Avoidance of groups bc of speech
  3. Feeling tense while talking because of distorted speech
  4. Avoidance of going out bc of speech

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Predictors of speech and swallowing function following primary surgery for oral and oropharyngeal cancer

Zuydam, A.C.,* Lowe, D.,† Brown, J.S.,‡ Vaughan, E.D.,‡ & Rogers, S.N.,‡

- 238 OC, 34 OPC, 6 maxillary sinus
- UW – QOL pre, 6-mos, 1 year, longer

- PREDICTORS of Speech outcomes (on UW-QOL) at 12 mos:
  - Tumor size (smaller = better)
  - XRT (none = better)
  - Closure/reconstruction (primary = better)
  - Neck dissection (less extensive = better)

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Zyudam et al - Results

- Importance of speech function to survivors at 1yr – relative to other choices
  - Saliva (14)
  - Chewing (13)
  - Speech (13)
  - Swallowing (10)
  - Activity (8)
  - Appearance (7)
  - Anxiety (6)
  - Taste (6)
  - Mood (5)
  - Pain (5)
  - Shoulder (4)
  - Recreation (2)

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What to make of it all? – some nuggets

- Greater resection volume = worse speech (Bohle et al., 2005; Furia et al., 2001; Ji et al., 2017)
- Increased tongue mobility & strength = higher SI [partial & hemi] (Kreeft et al., 2009; Lazarus et al., 2013)
- Highly variable SI after total and subtotal (Kreeft et al., 2009)
- Correlation bulk and contours of reconstructed tongue (Kimata et al., 2003; Seikaly et al., 2003)
- Maxillectomy reduces speech function & SI → but generally well managed prosthetically (Futran et al., 2002)

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More Nuggets

- Patient reported speech outcomes = lower than clinical measures (Rinkel et al., 2015)
- Radiation Therapy Impact?
  - RT as primary: variable outcomes
  - RT as adjuvant: tends to worsen speech outcomes (Keeft et al., 2009)

Negative Impact	No Significant Impact
Stelzle, et al. (2013	Laaksonen et al. (2010, 2011)
Bozec et al. (2009)	Pauloski et al. (1998)
Nicoletti et al. (2004)	

- Soft palate involvement = worse speech outcomes (Bohle et al., 2005)

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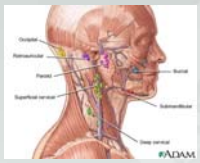
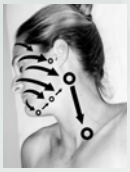
Lymphedema – speech?





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More..

- Lymphedema impact?
  - Acute and latent impacts on speech reported (Deng et al., 2013; Jackson et al., 2016; Payakachat et al., 2013)
  - "my tongue swelling, it impacted my speech… it impacted my ability to eat" (Deng et al., 2016, p.1271)
- *"At times I feel my tongue is too big for my mouth and my speech is then very slurred and much worse than what it is now… very difficult to understand" (Jeans et al., 2018, p.5)*
- *"I'm not talking normal because of the swelling of the tongue" (Jeans et al., 2018, p.5)*

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SLP Roles: Pre-operative/Pre-XRT

- Baseline:
  - Speech production – characteristics, deficits
  - Intelligibility
  - Communication needs
  - Speech-Com QOL
  - Cognitive-Comm
  - Phoneme inventory
  - Oral mech exam

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SLP Roles: Pre-operative/Pre-XRT

Baseline	Tasks/Tools
Communication needs & wishes	Interview, self-report
Speech impact	Speech Handicap Index (Rinkel et al., 2008; Dwivedi et al., 2011)) Communication Participation Inventory Bank (CPIB) (Yorkston et al., 2013)
Speech Production	Phoneme Inventory or Artic Test Ratings or measurements of…
Speech Intelligibility, Acceptability	SIT test; ratings/scaling
Oral mech exam	Rate, range, speed, coordination; symmetry
Hearing	Make sure it is not forgotten
Cognitive-Communication	

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SHI

Table 1
Speech Handicap Index question layout.

1. My speech makes it difficult for people to understand me
2. I run out of air when I speak
3. The intelligibility of my speech varies throughout the day
4. My speech makes me feel incompetent
5. People ask me why I'm hard to understand
6. I feel annoyed when people ask me to repeat
7. I avoid using the phone
8. I'm tense when talking to others because of my speech
9. My articulation is unclear
10. People have difficulty understanding me in a noisy room
11. I tend to avoid groups of people because of my speech
12. People seem irritated with my speech
13. People ask me to repeat myself when speaking face-to-face
14. I speak with friends and neighbors or relatives less often because of my speech
15. I feel as though I have to strain to speak
16. I find other people do not understand my speaking problem
17. My speaking difficulties restrict my personal and social life
18. The intelligibility is unpredictable
19. I feel left out of conversations because of my speech
20. I use a great deal of effort to speak
21. My speech is worse in the evening
22. My speech problem causes me to lose income*
23. I try to change my speech to sound different*
24. My speech problem upsets me
25. I am less outgoing because of my speech problem
26. My family has difficulty understanding me when I call them throughout the house
27. My speech makes me feel handicapped
28. I have difficulties to continue a conversation because of my speech
29. I feel embarrassed when people ask me to repeat
30. I'm ashamed of my speech problem

How do you rate your own speech at this moment (please circle the right answer)*

Excellent, Good, Average, Bad

Questions in bold are the one used to calculate scores of speech domain.
Questions not in bold (except with *) were used to calculate scores of psycho-social domain.
* Additional question to evaluate overall speech.

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CPIB

The Communicative Participation Item Bank – General Short Form

Instructions:
The following questions describe a variety of situations in which you might need to speak to others. For each question, please mark how much your condition interferes with your participation in that situation. By "condition" we mean ALL issues that may affect how you communicate in these situations including speech conditions, any other health conditions, or features of the environment. If your speech varies, think about an AVERAGE day for your speech – not your best or your worst days.

	Not at all (3)	A little (2)	Quite a bit (1)	Very much (0)
1. Does your condition interfere with…talking with people you know?	○	○	○	○
2. Does your condition interfere with…communicating when you need to say something quickly?	○	○	○	○
3. Does your condition interfere with…talking with people you do NOT know?	○	○	○	○
4. Does your condition interfere with…communicating when you are out in your community (e.g. errands; appointments)?	○	○	○	○
5. Does your condition interfere with…asking questions in a conversation?	○	○	○	○
6. Does your condition interfere with…communicating in a small group of people?	○	○	○	○
7. Does your condition interfere with…having a long conversation with someone you know about a book, movie, show or sports event?	○	○	○	○
8. Does your condition interfere with…giving someone DETAILED information?	○	○	○	○
9. Does your condition interfere with…getting your turn in a fast-moving conversation?	○	○	○	○
10. Does your condition interfere with…trying to persuade a friend or family member to see a different point of view?	○	○	○	○

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Hearing Status

- Age-related decline is possible
- Treatment related alteration (chemo) also possible
  - Cisplatin + radiation = SNHL (e.g., Hitchcock et al., 2009; Zuur et al., 2007)
- Baseline hearing prior to starting radiation-chemo-surgery; period reassessment after

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Cognitive Function (CF)

- Baseline is important
- Post
- Periodic assessment thereafter

- Bond et al (2012, 2016): CF decrease even before Tx; 13% with language deficits post chemorad
- Gan et al (2011):
  - CF decline in 90% of HNC pts at 16 months post
  - Degree of CF correlated with radiation dose
  - Various memory abilities = most impacted
- Hsiao et al (2010) - similar

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Post Surgery

- What was done?
- What structures are left?
- How do they move?
- Further plans? - more surgery; chemoradiation; prosthetics?

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SLP Roles Post: Repeat
Lingual and Labial Cancer Patients

Baseline	Tasks/Tools
Communication needs & wishes	Interview, self-report
Speech impact	Speech Handicap Index (Rinkel et al., 2008) Communication Participation Inventory Bank (CPIB) (Yorkston et al., 2013)
Speech Production ★	Phoneme Inventory or Artic Test Ratings or measurements of…
Speech Intelligibility, Acceptability ★	SIT test; ratings/scaling
Oral mech exam ★	Rate, range, speed, coordination; symmetry
Hearing	Make sure it is not forgotten
Cognitive-Communication	?

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SLP Roles Post: Specific to Lingual

- 2 primary roles
  - Communication rehabilitation
  - Participation in prosthetic attempts
    - Palatal augmentation
    - Lingual prosthetic

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SLP Roles Post: Specific to Lingual
Lingual Prosthetics




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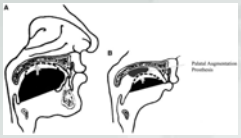
SLP Roles Post: Specific to Lingual
Palatal Augmentation Prosthesis

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Review Article

Speech and Swallowing Data in Individual Patients Who Underwent Glossectomy after Prosthetic Rehabilitation

Viviane de Carvalho[1] and Luiz Ubirajara Sennes[2]

- 5 studies specific to Oral Cancer only – palatal augmentation
  - 3/5 = improved speech intelligibility
  - More improvement in those with larger resections
  - 1 other showing vowel formants closer to pre-op

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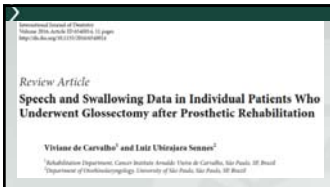

Review Article

Speech and Swallowing Data in Individual Patients Who Underwent Glossectomy after Prosthetic Rehabilitation

Viviane de Carvalho[1] and Luiz Ubirajara Sennes[2]

- 14 studies specific to Oral and Base of Tongue – palatal augmentation and lingual prostheses
  - Intelligibility improve for vowels (2 studies), consonants (5), sentences (1), conversation (6)
  - Improved resonance (4)
  - Improved voice quality (3)

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SLP Roles Post:
Lingual & Palatal Augmentation Prosthesis

- Be on the team
  - Maxillofacial Prosthodontist
  - You
  - Head & Neck Surgeon
  - Dietetics
  - Etc.
- Speech (and swallow) evals
  - Baseline
  - During construction as appropriate
  - Post final construction
- Primary speech foci = SI

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SLP Interventions

- What's been tried?
- Does it work?

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SLP Interventions for Glossectomy
What's been tried?

- Understand …
  - Remaining structures
  - Movement capabilities
  - Relation to other structures
- Train alternative productions of problematic speech sounds

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SLP Roles Post: Specific to Labial

- Pre-post testing of maxillary and velopharyngeal prosthetics
- How to
  - Perceptual
  - Nasometry
  - Flexible endoscopy
  - Aerodynamics

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Tongue Resections – historically attempted substitutions for consonants

Phoneme	Strategy
t/d/n	sub lower lip for tongue tip
s/z/	slit btw upper/lower teeth or slit btw tensed/spread lower lips
k/g/ng	pharyngeal contact with ?
l	midpoint lip-lip; buccal?
r	vocalic /r/; overlap lips
th	draw lower lip down from inside of upper lip and teeth
sh, ch	nothing great (try for any fricative)

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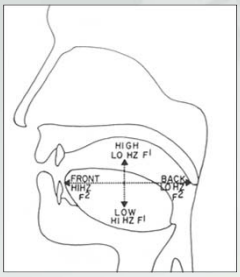
and Vowels ? – usually less focus
(more so with total and near-total glossectomy)



Vowels	Strategy
front/back (e/a)	mandibular thrust
hi/lo (i/ae)	mand. Elevation
short/long (i/I)	duration

NOTE:
Old training lit mostly regarding people with laryngectomy + glossectomy

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SLP Roles Post: Specific to Palatal

- Expectations – usually not much
- General intelligibility strategies

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Does SLP Intervention Help?

ORIGINAL ARTICLE

Speech Intelligibility After Glossectomy and Speech Rehabilitation

- N=27 in 3 groups
  - Total glossectomy (GRP1)
  - Subtotal glossectomy (GRP2 – retained BOT)
  - Hemiglossectomy (GRP3)
- 10-12 Tx session [3-6 months]
- Rating 0-7 "understandable … vowels, CV, VCV
- "Intelligibility" rated (4 pt scale) – spontaneous speech

1. *Intelligible* indicates clear, with no difficulty whatever understanding the speech;
2. *Partially intelligible*, some difficulty understanding part of the sentence, but no loss in understanding the story;
3. *Intelligible with attention*, much difficulty understanding part of the sentence, with loss in comprehension of the story; and
4. *Unintelligible*, impossible to understand the sentence and all of the story.

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ORIGINAL ARTICLE

Speech Intelligibility After Glossectomy and Speech Rehabilitation

What was the therapy?

- Maximize residual tongue movement
- Adaptive articulation
- Reduce negative compensations

- Vowel differentiation practice – isolation and combo with bilabials
- Phoneme inventory review and train consonant replacements as possible
- Pitch and intensity range (vowels?)
- Reduce speaking rate
- Saliva management
- Overarticulation training
- Yawn-chewing (for jaw? voice?)

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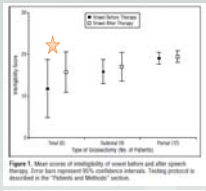
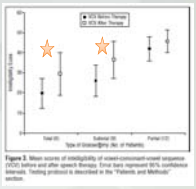
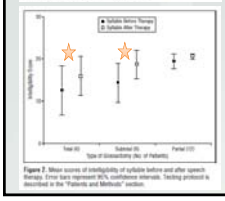
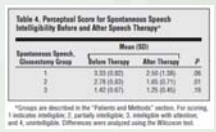
The Results









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Skelly et al. (**1971**). Compensatory physiologic phonetics for the glossectomee. *Journal of Speech and Hearing Disorders, 36,* 101-112.

- N=25 (14 totals and 11 partials)
- SLP Tx for all – started 9mos to 2 years post surgery
- Speech intelligibility assessed pre- and post-Tx
  - W-22 PB Word Lists
  - 3 listeners from pool of 27 listeners per subject
- Functional communication test

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What did Skelly do?

- SLP Tx program – 12 months
  - Non-speech exercises – "excursion"
  - "drill for intelligibility" of vowels, consonants
  - Exploring compensatory artic with remaining articulators
  - Identifying those compensations that positively impact intelligibility
- Also did cinefluoroscopic studies of 5 patients

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TABLE 3. Intelligibility summary, total glossectomees. Note: Rank order in which patients are listed was determined by consensus of three staff speech pathologists. The dysphagic patients (9 through 14) were all considered to rank ninth.

Clinician Ranking of Patients	CID W-22 PB Pre	CID W-22 PB Post	Glossal Monosyllables Pre	Glossal Monosyllables Post	Life Situation Questions Pre	Life Situation Questions Post
1	8	42	2	38	4	76
2	6	40	0	36	12	76
3	8	34	4	26	8	66
4	6	24	0	30	0	56
5	4	26	0	22	4	46
6	4	20	0	16	0	40
7	4	18	0	14	0	40
8•	0	18	0	12	0	26
9••	0	0	0	0	0	0
10••	0	0	0	0	0	0
11••	0	0	0	0	0	0
12••	0	0	0	0	0	0
13••	0	0	0	0	0	0
14••	0	0	0	0	0	0

•Also laryngectomy
••Dysphagic

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TABLE 4. Intelligibility summary, partial glossectomees.

Clinician Ranking of Patients	CID W-22 PB Pre	CID W-22 PB Post	Glossal Monosyllables Pre	Glossal Monosyllables Post	Life Situation Questions Pre	Life Situation Questions Post
1	16	46	10	30	56	86
2	24	42	20	50	56	88
3	12	36	16	30	42	76
4	20	40	20	40	54	78
5	12	34	20	34	40	65
6	12	34	16	26	40	60
7	8	26	14	24	40	58
8	6	24	10	20	36	56
9•	6	–	12	–	24	–
10•	8	–	10	–	28	–
11•	6	–	10	–	26	–

•Three patients dropped from program in the early stages.

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Skelly et al. (1972). Changes in phonatory aspects of glossectomee intelligibility through vocal parameter manipulation. *Journal of Speech and Hearing Disorders, 37,* 379-389.

- N = 10 (total glossectomy) plus 10 controls (other cancers of neck , mandible)
- SLP Tx for this study initiated 16 weeks to 9 years post surgery (all had completed articulatory therapy prior to the therapy offered in this study)
- SLP Tx designed for 4 months duration, weekly sessions, homework

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Skelly et al. (1972). Changes in phonatory aspects of glossectomee intelligibility through vocal parameter manipulation. *Journal of Speech and Hearing Disorders, 37,* 379-389.

- The therapy goals:
  - Reduction of oral and pharygneal noises
  - Adjustment of vowel duration
  - Elevation of habitual pitch
  - Extension of pitch range
  - Improved resonance of higher harmonics

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Skelly et al. (1972). Changes in phonatory aspects of glossectomee intelligibility through vocal parameter manipulation. *Journal of Speech and Hearing Disorders, 37,* 379-389.

- The therapy approach:
  - Various throat relaxation activities (borrowed from singers)
  - Yawn-sigh vowels, voicing during rotary chewing
  - Vowel duration activities (max, short but loud)
  - Pitch practice (habitual:vowels, words, phrases, convo; variation: intonation exercises)

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Skelly et al. (1972). Changes in phonatory aspects of glossectomee intelligibility through vocal parameter manipulation. *Journal of Speech and Hearing Disorders, 37,* 379-389.

TABLE 1. Pre- and postproject scores and measures for the experimental group.

Clinician Ranking	Intelligibility Test Scores (Norm 100%) Pre %	Post %	Gain	Mean Harmonic Frequency High (Norm 8 K Hz) Pre K Hz	Post K Hz	Mean Duration in Sec (Norm 0.49 sec) Pre sec	Post sec
1	57	72	15	3.42	6.14	0.72	0.56
2	55	71	16	2.71	5.00	0.59	0.54
3	50	66	16	2.92	4.64	0.73	0.57
4	45	55	10	2.42	4.55	0.80	0.68
5	34	44	10	2.00	3.28	0.76	0.68
6	25	35	10	2.50	3.14	0.95	0.78
7	24	30	6	1.42	2.35	0.84	0.71
8	20	20	0	0.50	1.42	0.27	0.27
9	15	15	0	0.50	0.50	0.20	0.25
10	10	10	0	0.50	0.50	0.25	0.25

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Takatsu et al (2016)

- N=62; partial glossectomy, various reconstruction
- Assessed vowel space area and formant transition slopes for /a/, /i/, /u/
- Vowel space and formant slopes decreased pre-post surgery
- Post-SLP, increased space and slopes

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Blythe et al (2015)

- Systematic review re: SLP intervention outcomes with people who have partial glossectomy
  - 1422 articles screened
  - 76 reviewed
  - 7 met criteria for inclusion
- All were level III or IV (Oxford) – most were case series, one was quasi-experimental

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Blythe et al

- Trends
  - Interventions varied
    - individually prescribed for compensations
    - range of motion
    - Other (some re: rate, voice, etc.)
  - Essentially all demonstrated improvement in intelligibility
    - Study quality generally low
    - Mixed Tx approaches within same participant

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SLP Roles Post: Palatal Tumor

- Hard Palate =

  maxillary prosthetics

- Soft Palate =

  velopharyngeal prosthetics or flaps

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SLP Roles Post: Palatal Tumor

Be on the Prosthetics Team

- Speech (and swallow) evals
  - Baseline
  - During construction as appropriate
  - Post final construction
- Focus
  - Nasal Escape/Resonance
  - Intelligibility, understandability

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SLP Roles Post: Palatal Tumor

- Nasal Escape/Resonance
  - Perceptual ratings of
    - hypernasality = vowel phenomenon
    - nasal emission = consonant phenomenon ("audible burst on pressure consonant")
  - Instrumental Assessments
    - Flexible endoscopy of VP closure
    - nasometry
    - Aerodynamic assessment

HYPERNASALITY (nas. flutter)

1. He will read to Lee. /li/
2. Will we leave at three?
3. You were rude to Lou. /lu/
4. Who drew the bluebird?
5. Ruby grew three trees.

(control) 6. Bob had our dollar. /la/

Spontaneous speech rating:

NASAL EMISSION

1. Paula paid Perry. /pa/
2. Terry told Teddy. /ta/
3. Kelly called Carla. /ka/
4. Father fed Fido. /fa/
5. Sally saved Sarah. /sa/
6. Sherry shoved Shelly. /ʃa/
7. Charlie chewed chili. /tʃa/
8. Sarah slid slowly. /sla/
9. Sally smelled smoky. /sma/

(control) 10. Riley road railroads. /ra/

Spontaneous speech rating:

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SLP Role Post: Labial Cancer surgery

- Literature tells us what…?
  Essentially no empirical data published about effectiveness or efficacy of any intervention
- Typically limited to no need for SLP involvement unless total labial resection/reconstruction
- Our basis for intervention
  - Logic and understanding of
    - normal speech sound production
    - abilities of remaining articulators
  - Expert opinion

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Questions