

Management of Swallowing in the Treated Head and Neck Cancer Patient

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Speech Pathologist Role

- Team member providing input regarding potential effects of treatment on voice, speech and swallowing
- Determine patient's level of understanding of upcoming treatment
- Provide information to patient regarding SLP/patient roles during/post-treatment
- Manage voice, speech and swallowing problems



Pre-treatment Counseling

- What is patient's understanding of upcoming tx? Expectations?
- Explain SLP role in rehabilitation
- Define patient's role in rehabilitation
- Predicting outcome re: voice, speech and swallowing post-tx



Treatment Information – helps predict degree of impairment

- Operative reports
- Chemo and radiotherapy summary reports (i.e., ports/fields of treatment for radiotherapy)
- Communication with physicians regarding resection/reconstruction and any complications



Treatment - management

- Wait until consult to assess patients for communication/swallowing – timing depends on type of surgery and reconstruction
- Follow patients during and after tx:
 - Anticipate changes/relapse in voice (i.e., laryngeal, esophageal, tep), speech and swallowing
 - Anticipate reduced ability to practice exercises
 - Provide encouragement support and monitoring of functioning



Partial laryngectomy – vertical/hemilaryngectomy

- Standard resection
- Extended hemilaryngectomy



Hemilaryngectomy - reconstruction

- Using portion of epiglottis to fill surgical defect
- Epiglottic pull-down
- Using available tissue/fascia
- Using free flap reconstruction (i.e., radial forearm free flap)



Hemilaryngectomy - disorders

- Reduced glottic closure
- Reduced laryngeal vestibule closure
(particularly if resection and/or reconstruction involves epiglottis and/or arytenoid cartilage or reconstruction with free flap)



Hemilaryngectomy- VFG study

- examine laryngeal anatomy
- examine airway closure at vestibule and glottic levels
- introduce strategies to improve airway closure



Hemilaryngectomy - VFG study

- chin down
- head rotation
- chin down & head rotation
- super supraglottic swallow
- super supraglottic swallow & chin down (& head rotation)
- thicker boluses



Treatment: Postures*

- 165 consecutive patients with aspiration noted on MBS, with patient population including:
 - 59% H&N
 - 47% CVA
 - 12% closed head injury
 - 9% progressive neurologic disease
 - 7% adductor paralysis
 - 5% generalized weakness
 - 4% Zenker's diverticulum
 - 3% cerebral palsy
 - 3% CNS involvement from AIDS
 - 2% craniotomy for aneurysm repair
 - 4% uncertain

* Rasley, A., Logemann, J.A., Kahrilas, P.J., Rademaker, A.W., Pauloski, B.R. & Dodds, W.J. (1993). Prevention of barium aspiration during videofluoroscopic swallowing studies: value of change in posture. *American Journal of Roentgenology*, 160, 1005-1009.

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Treatment Options: Postures*

- Postures were attempted, based on swallow physiology, including:
 - chin tuck
 - head back
 - head rotation
 - side lying

* Rasley, A., Logemann, J.A., Kahrilas, P.J., Rademaker, A.W., Pauloski, B.R. & Dodds, W.J. (1993). Prevention of barium aspiration during videofluoroscopic swallowing studies: value of change in posture. *American Journal of Roentgenology*, 160, 1005-1009.



Treatment Options: Postures*

Results:

- 127 (77%) patients aspiration was eliminated for at least 1 bolus volume
- aspiration was eliminated for all four bolus volumes and cup drinking in 25% of patients (chin tuck in 25% of patients; head rotation in 26% of patients)
- of the 23% where aspiration was not eliminated:
 - primarily due to patient's inability to perform and maintain postures or;
 - severity of head and neck surgical procedures (i.e., extended partial laryngectomy procedures)

* Rasley, A., Logemann, J.A., Kahrilas, P.J., Rademaker, A.W., Pauloski, B.R. & Dodds, W.J. (1993). Prevention of barium aspiration during videofluoroscopic swallowing studies: value of change in posture. *American Journal of Roentgenology*, 160, 1005-1009.



Treatment: Postures*

- Examined 32 consecutive H&N surgical patients with aspiration on liquids during MBS exam
- Postures +/- maneuvers were attempted, based on swallow physiology, including:
 - chin tuck
 - head back
 - head rotation
 - head rotation plus supraglottic swallow
 - chin tuck plus supraglottic swallow
 - combined head rotation and chin tuck
 - side lying

* Logemann, J.A., Rademaker, A.W., Pauloski, B.R., Kahrilas, P.J. (1994). Effects of postural change on aspiration in head and neck surgical patients. *Otolaryngology Head and Neck Surgery*, 4, 222-227.

Treatment: Postures*

- 81% (26) were able to swallow at least one volume of liquid without aspiration with postures
- each posture eliminated aspiration in at least 50% of the patients
- in 19% of the patients, postural techniques enabled safe cup drinking
- postures were ineffective in 6 patients:
 - 2 extended supraglottic laryngectomees
 - 2 extended hemilaryngectomees
 - 1 with tracheal resection and unilateral TVC paralysis
 - 1 oral composite resection and pharyngeal wall resection

* Logemann, J.A., Rademaker, A.W., Pauloski, B.R., Kahrilas, P.J. (1994). Effects of postural change on aspiration in head and neck surgical patients. *Otolaryngology Head and Neck Surgery*, 4, 222-227.



Supraglottic laryngectomy - reconstruction

- Laryngeal suspension
- Replacement of portion of arytenoid with tissue/bone



Supraglottic laryngectomy - disorders

- Reduced/incomplete closure of airway entrance
- Reduced glottic closure (if portion of arytenoids and/or vocal folds are resected)
- Reduced pharyngeal clearance
- Impaired tongue base motion (particularly if portion of BOT is resected)



Supraglottic laryngectomy – VFG study

- Examine laryngeal anatomy
- Examine airway closure
 - supraglottic – laryngeal vestibule closure is now defined by tongue base to arytenoid contact
 - glottic

Supraglottic Laryngectomy - VFG study

- super supraglottic swallow
- head rotation
- chin down
- chin down & head rotation
- chin down, head rotation, & super supraglottic swallow
- thicken liquids
- lying down



Supraglottic Laryngectomy - treatment

- tongue base retraction exercises
- effortful swallow
- tongue-hold maneuver (Masako)
- supraglottic/glottic closure exercises
 - super supraglottic swallow
 - voice exercises
- biofeedback – videonasendoscopy to visualize airway closure techniques



Cricohyoepiglottopexy (CHEP) and Near total laryngectomy

- Tumor is typically laryngeal
- Thyroid cartilage is resected
- At least one arytenoid cartilage is preserved to construct neoglottis
- Part/all of cricoid cartilage is preserved
- Some of epiglottis is preserved
- Voice quality varies
- no studies examining swallow physiology
- patients do aspirate*
- Allows for decannulation

* Laccourreya, et al., 1998



Cricohyoidoepiglottopexy (CHEP) vs. Near total laryngectomy (NTL) – Results*

- Mean decannulation time similar (27 days)
- NG removal 23 days (CHEP) vs. 17 days (NTL)
- No pulmonary complications
- 9/17 CHEP pts vs. 6/21 NTL pts had grade 1 late post-operative aspiration

* Osyu C, Aslan I (2006) cricophyoidoepiglottopexy vs near-total laryngectomy with epiglottic reconstruction in the treatment of early glottic carcinoma Arch Otolaryngol Head Neck Surg 132:1065-1068.



Total Laryngectomy - disorders

- mild reduction in tongue movement
- stricture
- pseudo-epiglottis
- pharyngo-cutaneous fistula
- tracheo-esophageal fistula



Total Laryngectomy - treatment

- reduction in tongue movement - tongue exercises
- stricture – dilatation, postural changes: head rotation
- pseudo-epiglottis - surgical removal
- pharyngo-cutaneous fistula – closure
- tracheo-esophageal fistula - closure



Laryngopharyngo-esophagectomy (with gastric pull-up)

- swallow typically unimpaired
- no PE segment
- altered peristalsis
- treatment:
 - creation of PG (pharyngo-gastric) segment for voice production



Laryngopharyngoesophagectomy (esophageal reconstruction): Reconstruction techniques

- Gastric pull-up
- Jejunum transposition
- Tubed radial forearm free flap



Esophagectomy without Laryngectomy - Disorders

- impaired laryngeal vestibule closure
- impaired laryngeal elevation/gastric opening



Esophagectomy without Laryngectomy - Treatment

- chin down posture
- chin down posture + super supraglottic swallow
- Mendelsohn maneuver
- falsetto exercises
- Shaker exercises



Treatment: Postures*

- examined 21 patients with esophagectomy
- all patients underwent MBS evaluation
- chin tuck posture eliminated aspiration in 81% of the patients

* Lewin JS, Herbert TM, Putnam JB, DuBrow RA. (2001) Experience with the chin tuck maneuver in postesophagectomy aspirators. *Dysphagia* 16:216-219



Treatment: Postures*

- 73 esophagectomy patients examined by MBS (4 - 35 days post-op)
- Identification of laryngeal penetration and/or aspiration

* Champion MB, Jones B, Gayler BW, Yang SC. (2006) *The esophagectomy patient: Early intervention by speech pathology improves outcome.* presented at the Annual DRS Meeting, Scottsdale, AZ.



Treatment: Postures*

- Results: 47% demonstrated laryngeal penetration/aspiration
- 5% demonstrated silent aspiration
- 32% diagnosed with leak at anastomosis

* Campion MB, Jones B, Gayler BW, Yang SC. (2006) *The esophagectomy patient: Early intervention by speech pathology improves outcome.* presented at the Annual DRS Meeting, Scottsdale, AZ.



Treatment: Postures*

- Of patients without leaks:
 - Compensatory swallow techniques tried on 40% of penetrators/aspirators (postures and/or maneuvers (SSG))
 - 90% of patient penetration and/or aspiration were eliminated

* Champion MB, Jones B, Gayler BW, Yang SC. (2006) *The esophagectomy patient: Early intervention by speech pathology improves outcome.* presented at the Annual DRS Meeting, Scottsdale, AZ.



Management of oral cancer patients

- pre- and post-op counseling
- bedside exam
- radiographic study of swallowing
- therapy and/or construction of palatal prostheses





Types of oral cancer surgeries

- partial glossectomy
- anterior composite resection
- posterior/lateral composite resection
- total glossectomy

Surgical reconstruction in oral cancer surgery

- primary closure
- local flap (i.e., tongue flap)
- regional flap (i.e., chest flap)
- distal/free flap (i.e., radial forearm free flap)
- sensate flap



Anterior Oral Cancer Resection - disorders

- Reduced bolus control and chewing
- Reduced bolus hold and seal against palate
- slowed oral transit with repetitive tongue movements
- delayed pharyngeal swallow
- reduced laryngeal elevation and cricopharyngeal opening (if floor of mouth muscles are cut/damaged)



Posterior Oral/Oropharyngeal Surgery - disorders

- reduced bolus control and chewing
- slowed oral transit w/repetitive tongue movements
- delayed pharyngeal swallow
- reduced tongue base retraction
- reduced pharyngeal contraction
- reduced laryngeal elevation/reduced UES opening



Total glossectomy - disorders

- no chewing ability
- limited ability to propel bolus into pharynx
- delayed pharyngeal swallow
- reduced tongue base motion
- reduced laryngeal motion/reduced UES opening



Clinical exam following oral cancer surgery

- assess lingual, mandibular, and palatal motion
- assess labial and lingual sensation
- assess labial and lingual ROM
- assess triggering of pharyngeal swallow
- assess lingual-palatal contacts/narrowing for stop consonants, affricates and fricatives



Radiographic study of swallowing

- define oral anatomy and dynamics
- assess bolus volume effects
- assess bolus viscosity effects
- therapeutic strategies
 - super supraglottic swallow
 - dump and swallow
 - thermal/tactile stimulation
 - Mendelsohn maneuver
 - Effortful swallow
 - Postures – head tilt/head back



Speech and swallow therapy after oral cancer surgery

- range of motion exercises for tongue and jaw (and lips, as needed)
- lingual control exercises
- tongue strengthening exercises
- thermal/tactile stimulation
- construction of intraoral prosthetics
- swallow maneuvers, as appropriate
- speech exercises



Furia, et al., (2000)*

- Examined swallowing via MBS in glossectomy patients
 - Partial glossectomy
 - Subtotal glossectomy
 - Total glossectomy

*Furia et al. (2000) Videofluoroscopic evaluation after glossectomy.
Arch Otolaryng Head Neck Surg. 126:378-383.



Furia, et al., (2000) - results

- Increased oral transit times
- Stasis of food in oral cavity, pharynx and UES region
- 2/15 with moderate and silent aspiration (both pts had pre-op XRT)
- Mendelsohn and Supraglottic swallow improved swallow function
- Compensation with lips and mandible



Furia, et al., (2001)*

- Examined speech in 3 groups of glossectomy patients (total, subtotal, partial)
- Examined speech pre- and post-speech tx
 - Maximizing residual lingual movement
 - Articulatory compensation
 - Reducing rate
 - Improving intonation, pause duration, intensity

* Furia, et al. (2001) Speech intelligibility after glossectomy and speech rehabilitation. Arch of Otolaryngol Head Neck Surg. 127:887-883.



Furia, et al., (2001)

- Significant improvement in mean intelligibility for groups 1 (total) and 2 (subtotal), but not for group 3 (partial glossectomy)
- 25/27 were receiving all oral nutrition following tx program
- Even with 50% tongue resection, vowel and consonant articulation was good



Treatment: ROM exercises*

- Examined speech & swallow function in 102 patients surgically treated for oral and oropharyngeal CA to determine relationship between total amount of speech and swallow tx between 1 and 3 months post-op and changes in global measures of speech and swallow functions:
 - OPSE (oropharyngeal swallow efficiency measure)
 - Intelligibility

* Logemann, J.A., Pauloski, B.R., Rademaker, A.W., Colangelo, L.A. (1997). Speech and swallowing rehabilitation for head and neck cancer patients. *Oncology*, 5, 651-659.



Treatment: ROM exercises*

- 102 pts received speech tx, 92 pts received swallow tx (including ROM, sensory enhancement, maneuvers)
- ROM exercises included:
 - Lips
 - Tongue
 - Jaw
 - Larynx
 - Falsetto
 - Effortful breath-hold

* Logemann, J.A., Pauloski, B.R., Rademaker, A.W., Colangelo, L.A. (1997).
Speech and swallowing rehabilitation for head and neck cancer patients.
Oncology, 5, 651-659.



Treatment: ROM exercises*

- Significantly higher OPSE measures in the ROM exercise group
- Greater number of bolus types and volumes during MBS re-evaluation
- Significantly higher intelligibility scores in the ROM exercise group

* Logemann, J.A., Pauloski, B.R., Rademaker, A.W., Colangelo, L.A. (1997). Speech and swallowing rehabilitation for head and neck cancer patients. *Oncology*, 5, 651-659



Treatment: Strengthening Exercises*

- Case study: effects of tongue strengthening exercises in a surgically treated oral cancer patient
- Examined improvement in tongue strength and in swallow functioning

* Sullivan P, Hind JA, Roecker EB, Carnes M, Doyle J, Dengel GA, Robbins J. (2001). Lingual exercise protocol for head and neck cancer: A case study. *Dysphagia*, 16, 154.



Treatment: Strengthening Exercises*

- Found that tongue strength improved with exercise program
- Found that swallow functioning improved with exercise program
- Found that diet options increased with exercise program

* Sullivan P, Hind JA, Roecker EB, Carnes M, Doyle J, Dengel GA, Robbins J. (2001). Lingual exercise protocol for head and neck cancer: A case study. *Dysphagia*, 16, 154.



Treatment: Strengthening Exercises*

- 31 healthy subjects
- ages 20 to 29 years
- 23 females and 8 males (mean age = 26 yrs)

* Lazarus, C.L., Logemann, J.A., Huang, C.H., Rademaker, A.W.(2003) Effects of two types of tongue strengthening exercises in young normals. *Folia Phoniatica*, 55:199-205.



Treatment: Tongue Strengthening*

- Subjects were randomized to one of three groups:
 - 1) no exercise group
 - 2) exercise group receiving standard tongue strength exercises using a tongue depressor
 - 3) exercise group receiving tongue strength exercises with the IOPI

* Lazarus, C.L., Logemann, J.A., Huang, C.H., Rademaker, A.W.(2003) Effects of two types of tongue strengthening exercises in young normals. *Folia Phoniatrica*, 55:199-205.



Treatment: Tongue Strengthening - Exercise Protocol

- Tongue function testing included:
 - maximal isometric pressure generation
 - (P_{max} = strength)
 - submaximal pressure generation
 - (50% of P_{max} = endurance)



Maximum Strength*

	<u>No Treatment</u>			<u>With Treatment</u>			
	N	mean	sem	N	mean	sem	p-value
Baseline	10	69.8	5.6	21	64.4	1.9	0.36
1 month	10	71.2	5.4	21	73.1	1.6	
Difference	10	1.4	2.8	21	8.7	1.9	0.04
p-value	*	0.62			<0.001		

* p-value compares baseline to 1 month

* Lazarus, C.L., Logemann, J.A., Huang, C.H., Rademaker, A.W.(2003) Effects of two types of tongue strengthening exercises in young normals. *Folia Phoniatica*, 55:199-205.



Treatment: Tongue Strengthening - Exercise Protocol*

- 56 patients with nasopharyngeal CA who underwent CXRT
- Patients were randomized to tx/no tx groups pre-CXRT
- Variables:
 - Tongue strength
 - Swallowing (OPSE)
 - QOL (SWAL-QOL)
- Results: no significant changes in tongue strength or swallow function from pre to post-tx; significant changes in SWAL-QOL measures

* Chen S, Ting L, Chang Y, Ko Y, Chang C, Chiang S. (2006). Radiotherapy effects on swallowing & life quality to nasopharyngeal cancer. Presented at the Annual Speech-Language-Hearing Association Meeting, Miami, FL.

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Benefits of tongue strengthening exercises on swallowing in chemoradiotherapy patients??

NIH/NIDCD R03 grant to examine the effects of 2 types of exercise programs on tongue strength, swallowing and QOL in oral and oropharyngeal CA patients who have undergone CXRT

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Treatment: Strengthening Exercises*

- Healthy subjects placed on Shaker exercise program
- Laryngeal excursion increased
- UES opening increased

* Shaker R, Kern M, Bardan E, Taylor A, Stewart ET, Hoffmann RG, Arndorfer RC, Hofmann C, Bonevier J. Augmentation of deglutitive upper esophageal sphincter opening in the elderly by exercise. *Am J Physiol* 1997;272 (*Gastrointest Liver Physiol* 35):G1518-G1522.



Treatment: Strengthening Exercises*

- Dysphagic patients placed on Shaker exercise program
- Laryngeal excursion increased
- UES opening increased
- Swallow function improved, with reduction in aspiration, improvement in diet type/PO vs NPO status

* Shaker R, Easterling C, Kern M, Nitschke T, Massey B, Daniels S, Grande B, Kazandjian M, Dikeman K. (2002). Rehabilitation of swallowing by exercise in tube-fed patients with pharyngeal dysphagia secondary to abnormal UES opening. *Gastroenterology* 122:1314-1321.



Treatment: Strengthening Exercises*

- LSVT improves lingual strength and QOL in Parkinson's patients*
 - Increased tongue strength
 - Improved QOL (via SWAL-QOL)
- LSVT improves swallow function**
 - shorter oral transit times
 - reduced oral residue
 - Improved triggering of pharyngeal swallow

*Palmer PM, Wohlert AB, Easley E. (2004). *Oral function and quality of life after LSVT*. Poster presented at the American Speech-Language-Hearing Association Annual meeting, Philadelphia, PA.

** Sharkawi AE, Ramig L, Logemann JA, Pauloski BR, Rademaker AW, Smith CH, Pawlas A, Baum S, and Werner C. (2002). Swallowing and voice effects of Lee Silverman Voice Treatment (LSVT): A pilot study. *Journal of Neurology, Neurosurgery and Psychiatry*, 72(1):31-36.



Treatment: Strengthening Exercises*

- Respiratory strength training exercise improves swallow function
 - Increased hyoid motion during swallows
 - Reduced pharyngeal residue during swallows
 - Reduced aspiration during swallows

* Sapienza, C. (2006). Respiratory muscle strength training: Functional outcomes vs. plasticity. *Seminars in Speech and Language*,27:236-244.



Surgical variables affecting post-operative swallowing efficiency*

- 30 oral cancer patients (15 anterior lesions, 15 lateral floor of mouth/tongue lesions)
- liquids and pastes examined by VFG 3 months post-op
- Results: percentage oral tongue and tongue base resected significantly negatively correlated with oropharyngeal swallow efficiency (OPSE)

*McConnel et al. (1994) Laryngoscope, 104:87-90



Primary Closure vs. Flap Reconstruction*

- 284 treated oral cancer patients examined
- primary closure vs. distal flap vs. free flap (matched based on percentage oral tongue, tongue base resected)
- Examined temporal swallow measures and oropharyngeal swallow efficiency (OPSE) 3 months post-op via VFG examination

* McConnel et al. (1998) Arch Otolaryngol Head Neck Surg, 124:625-630.



Primary closure vs. flap reconstruction - Results*

Flap groups demonstrated:

- sign. lower OPSE
- sign. longer oral transit times
- sign. longer pharyngeal transit times
- sign. greater % oral & pharyngeal residue

*McConnel et al. (1998) Arch Otolaryngol Head Neck Surg, 124:625-630.



Swallowing after microvascular free flap reconstruction (MFFF) (2007)*

- Examined longitudinal swallowing via MBS and scintigraphy in 80 pts with oral and oropharyngeal resection and radial forearm free flap (RFFF) reconstruction in 3 groups of patients:
 - Oral tongue
 - Tongue base
 - Tongue base + tonsil/soft palate

* Borggreven et al. (2007). Swallowing after major surgery for the oral cavity or oropharynx: A prospective and longitudinal assessment of patients treated by microvascular soft tissue reconstruction. Head Neck 29:638-647.



Swallowing after microvascular free flap reconstruction (MFFF) (2007)

- Examined function at 6 and 12 months
- Found no differences in function at 6 vs 12 months
- Pre-swallow leakage to the pharynx occurred in 66% and 70% of patients
- Aspiration occurred in 34% and 25% of patients
- Swallowing severity was influenced by locus of resection (i.e., group 1 < group 2 < group 3)
- Abnormal OPSE for all 3 groups



Palatal Prosthetics

■ Palatal Lift

- velar tissue present, but not closing velopharynx: prosthesis elevates tissue for velopharyngeal (VP) closure

■ Palatal Obdurator

- Insufficient tissue for VP closure: prosthesis replaces lost tissue for VP closure

■ Palatal Augmentation

- insufficient tongue tissue for contact w/palate: prosthesis lowers palatal vault, shapes to the tongue and facilitates tongue-palate contact



SLP role in palatal augmentation prosthesis construction

- work closely with maxillofacial prosthodontist
- determine contour of augmentation (by visual, auditory, tactile inspection, x-ray study)
- provide swallow and speech exercises
- re-assess swallow with an x-ray study



Palatal Augmentation Prosthesis*

- improved oral transit times
- reduced percentage oral residue
- reduced percentage pharyngeal residue
- increased OPSE
- increased bolus head velocity (better tongue force applied to bolus)
- reduced # of repeat dry swallows

*Davis et al. (1987) J Prosthet Dent, 57:715-720;
Logemann, et al. (1989) Dysphagia, 4:118-120.



Swallow outcomes after oral cancer treatment - complaints

- increased eating time
- reduced diet options (e.g., blenderized, soft foods)
- residue of foods/liquids in surgical site



Swallow outcomes after oral cancer treatment - Diet

Pauloski et al. (1994):

- 38 surgically treated oral cancer patients
- % of patients attempting masticated consistency at 1 month VFG - 42%
- % of patients attempting masticated consistency at 3 month VFG - 66%



Physiologic effects of radiotherapy

- Early effects

- pain, soreness
- ulceration, bleeding
- erythema
- mucositis
- desquamation
- xerostomia



Physiologic effects of radiotherapy

- Late effects

- damage to arteries, arterioles, and capillaries, resulting in tissue fibrosis
- bone changes (osteoradionecrosis)
- trismus (restriction in mouth opening)
- altered tactile sensation
- altered or reduced taste sensation
- altered dental sensation
- changes in oral flora

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Mittal et al (2001)

- Examined two groups of H&N CA patients undergoing chemoradiotherapy
 - Group 1 – radiotherapy with tissue/dose compensation (TDC) (n=18)
 - Group 2 – high dose radiotherapy without TDC (n=21)



Mittal et al (2001)

- Examined:
 - Swallowing function
 - Speech function



Mittal et al (2001) - Results

- 4 patients developed esophageal strictures, 3 developed laryngeal strictures, laryngeal necrosis and mandibular fracture
- No patients in the TDC group developed any of these problems
- No sign. difference in salivary flow between the two groups (both decreased with time)



Mittal et al (2001) - Results

- TDC group of patients were able to swallow all tested bolus types in higher percentages than the non-TDC group and sign. more so with the 3 and 5mL volumes
- Trend towards better swallow measures, including oropharyngeal swallow efficiency (OPSE), in the TDC group



Mittal et al (2001) - Results

- Speech data revealed no sign. differences between groups, but individual consonant sounds were consistently more correctly produced in the TDC group



Carrara-de Angelis et al (2003)

- Examined voice and swallowing in 15 patients treated for laryngeal or hypopharyngeal CA with chemoRT
- Assessments within 2-9 months post-tx
- Identified swallow disorders
- Performed perceptual and acoustic analyses



Carrara-de Angelis et al (2003) – Results - Voice

- Ratings of dysphonia:
 - normal (7%)
 - mild (27%)
 - moderate (40%)
 - severe (27%)
- All acoustic measures were abnormal
- Significant correlations with perceptual grade and acoustic measures



Carrara-de Angelis et al (2003) – Results - Swallowing

- Reduced bolus formation (93%)
- Reduced bolus propulsion through the pharynx (86%)
- Reduced laryngeal elevation (36%)
- 36% aspirated (80% with silent aspiration)



Hughes et al (2000)

- Examined 50 patients with nasopharyngeal CA treated with primary radiotherapy
- Examined swallow disorders and durational measures (OTT,PTT)



Hughes et al (2000) - results

- Found increased OTTs and PTTs
- Identified disorders:
 - oral problems
 - delayed triggering of pharyngeal swallow
 - Impaired pharyngeal contraction
 - Reduced laryngeal elevation
- Of 22% who aspirated, 100% exhibited silent aspiration



Kendall et al (1998)

- Examined 20 patients 1 year post-RT for primary H & N cancer treatment and controls
- Examined pharyngeal structural movement:
 - Distance of hyoid movement
 - Extent of hyoid & larynx approximation
 - Width of UES opening
 - Pharyngeal area at rest and max constriction



Kendall et al (1998) - Results

- Sign. reduced laryngeal elevation as compared to controls
- UES width not sign. different from controls
- Pharyngeal area sign. larger at max constriction as compared to controls



Kotz et al (1999)

- Examined 24 patients with H & N CA (oral cavity, oropharynx, hypopharynx) treated with chemoradiotherapy
- Examined swallow disorders/measures
 - ID of pharyngeal phase disorders
 - Durational measures of laryngeal motion
- Time to VFG: 3 weeks to 44 weeks



Kotz et al (1999) - Results

- Impaired epiglottic motion
- Impaired laryngeal motion
- Impaired pharyngeal constrictor motion
- Greatest impairment of laryngeal motion found in patients with hypopharyngeal CA
- Of 27% who aspirated, all aspirated after the swallow



Lazarus et al (1996)

- Examined swallowing in 9 patients treated with chemoRT for H&N CA with oral, oropharyngeal, hypopharyngeal and laryngeal sites and age and gender-matched controls
- Identified swallowing disorders
- Performed biomechanical analysis of pharyngeal structural movement



Lazarus et al (1996) - Results

- Delayed triggering of swallow
- Impaired tongue base posterior motion
- Impaired hyo-laryngeal elevation
- Impaired laryngeal closure
- Impaired UES opening



Lazarus et al. (1996) - results

- Reduced pharyngeal structural movement as compared to normal
- Slowed/sluggish movement of pharyngeal structures – results in poorer bolus clearance through pharynx



Lazarus et al (2000)

- Examined 13 oral and oropharyngeal CA patients treated with chemoRT and 13 controls
- Prospective study with pre-tx and 2 month post-tx assessments:
 - VFG assessment
 - Tongue strength assessment



Subjects

- 13 oral and oropharyngeal CA patients
 - 10 males (mean=58)
 - 3 females (mean=57)
- 13 age and gender-matched normal subjects
 - 10 males (mean=56)
 - 3 females (mean=55)



Patients

- 12 patients Stage III-IV, 1 patient Stage I
- 13 patients treated with 7000+ cGy
- 12 patients - concurrent chemotherapy, 1 patient - radiotherapy alone



Treatment Volume

<u>Organ in RT field</u>	<u>Number of patients</u>
parotid gland	13
submandibular gland	13
oral tongue	13
tongue base	12
soft palate	12
oropharynx	12
hypopharynx	12
supraglottic larynx	5
entire larynx	6

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Protocol

- VFG swallow assessment
- Tongue strength assessment
 - maximum strength
 - endurance
- Patients
 - pre-tx and 2 months post-tx
- Normal Subjects
 - one assessment

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VFG Data Analysis

- Temporal analysis
- Observations
 - approximate percentage residue
 - number of swallows per bolus
 - percent, timing and etiology of aspiration
 - oropharyngeal swallow efficiency (OPSE)



Results

- Tongue strength did not change sign. from pre to post-tx in oral cancer patients
- Tongue strength was reduced pre- and post-tx in oral cancer patients as compared to controls
- Tongue strength correlated with swallow measures including:
 - oral transit time
 - oropharyngeal swallow efficiency (OPSE)
 - percentage oral residue
- Patients demonstrated pharyngeal phase swallowing impairment



Results

- Aspiration:
 - 1 subject aspirated pre-treatment
 - 7 subjects aspirated post-treatment
 - 6 aspirated after the swallow
 - 1 aspirated during and after the swallow
- Aspiration was due to pharyngeal phase disorders:
 - reduced tongue base posterior
 - reduced laryngeal elevation and closure



Tongue strength in oral & oropharyngeal CA patients after chemoRT – Results**

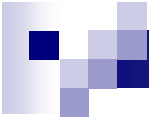
	<u>Pts -</u> <u>Pre-Tx</u>	<u>Normals</u>	<u>Pts - 2</u> <u>Months</u> <u>Post-Tx</u>	<u>Normals</u>
<u>Max</u> <u>Strength</u>	37.05 (±4.56)	60.15 (±3.68)*	42.77 (±5.3)	60.15 (±3.68)*
<u>Endurance</u>	30.67 (±4.53)	32.85 (±3.2)	42.92 (±6.81)	32.85 (±3.2)

* = p < .01

**Lazarus, et al. (2000) Journal of Speech-Language, and Hearing Research 43:1011-1023.

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Tongue strength and swallowing in oral & oropharyngeal CA patients after chemoRT: 12 month study*

Prospective study examining tongue strength and swallowing over a 12 month period in oral cancer patients treated with primary chemoradiotherapy

- * Lazarus CL, Logemann JA, Pauloski BR, Rademaker AW, Helenowski IB, Vonesh EF, MacCracken E, Mittal BB, Vokes EE, Haraf DJ. (2007). Effects of radiotherapy with or without chemotherapy on tongue strength and swallowing. *Head and Neck*. 29(7):632-637.



Subjects

- 46 subjects with oral and oropharyngeal cancer
 - 35 males (age range 36-78, mean age = 59)
 - 11 females (age range 29-75, mean age = 57)



Tongue strength and swallowing in oral & oropharyngeal CA patients after chemoRT: 12 month study*

Timepoint	<u>Mean Strength</u>	<u>n</u>
Baseline	47.0 (3.1)	46
1 month	41.7 (2.6)	35
3 months	51.0 (3.2)	22
6 months	57.5 (3.2)	24
12 months	54.7 (2.7)	16

*Lazarus et al., (2007)

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Diet Type and Evaluation Point

<u>Diet Type</u>	<u>Pre-tx</u> n=46	<u>1 mo</u> n=35	<u>3 mo</u> n=22	<u>6 mo</u> n=24	<u>12 mo</u> n=16	<u>p- value*</u>
Thin liquid	98%	83%	86%	88%	88%	0.24
Thick liquid	80%	40%	50%	75%	81%	0.0006
Pureeds	89%	66%	73%	79%	94%	0.052
Soft Mastic	83%	57%	77%	83%	94%	0.02
Crunchy Mast	67%	20%	32%	46%	63%	0.0002
Normal diet	67%	14%	23%	33%	56%	<0.0001
Oral intake > 50%	98%	63%	82%	79%	100%	0.0002

*p-value is for a significant difference across all time points





Results

- Max tongue strength was 7.5% higher in patients who could eat more than 50% of their food orally as compared with those who could eat 50% or less (p - .03)

Discussion

- Maximal tongue strength initially worsened (though not significantly) after chemoradiotherapy and improved over the year post-treatment
- Worsening may be due to side effects of chemoradiotherapy (e.g., mucositis, pain, soreness)
- Improvement likely due to lessening of side effects and improvement in physical status



Discussion

- Diet type tended to shift in the same direction as did tongue strength over the course of the year (i.e., ability to handle oral intake worsened at 1-month, as did tongue strength, and improved over time, as did tongue strength)
- Tongue strength may have played a key role in the ability of patients to handle some types of oral diet
- Tongue strength may have played a key role in the ability of patients to consume more viscous consistencies



Tongue strength in H&N patients treated with radiotherapy to varied sites*

- 13 patients treated with radiotherapy 1 month to 15 years prior to assessment
- All subjects underwent MBS assessment and tongue strength testing
- Tumor sites:
 - 1 oral tongue
 - 5 BOT/tonsil
 - 4 nasopharyngeal
 - 2 hypopharynx
 - 1 larynx

* Lazarus (2006) Tongue Strength and Exercise in Healthy Individuals and Head and Neck Cancer Patients. *Seminars in Speech Pathology* 27(4) 260-267.



Results

- All subjects demonstrated BOT retraction problems on MBS
- 1 subject demonstrated oral tongue impairment on MBS
- All subjects demonstrated tongue strength impairment



Discussion

- Regardless of tumor site, if oral tongue and/or base of tongue are included in treatment volume, tongue strength can become impaired following XRT
- Oral and/or pharyngeal phase swallow function can become compromised if tongue strength is reduced
- Tongue strength can become reduced long after XRT completion



Organ Preservation Treatment (Radiotherapy ± Chemotherapy) – SLP management

- pre-tx counsel re: possible swallow problems during and post-treatment
- perform baseline evaluation
- provide prophylactic swallow exercises
- monitor swallowing during treatment
- VFG swallow study, if needed
- provide treatment, as needed
- monitor swallowing after tx completion (tissue fibrosis)





Effects of Pretreatment Swallow Exercise on Dysphagia Quality of Life*

- 37 pts who underwent primary XRT or combined CXRT for new H&N tumors
 - 25 underwent pre-XRT/CXRT swallow exercise protocol
 - 12 received swallow tx post-XRT/CXRT (controls, post-XRT mean=14 months (6-20 mo))
- Outcome measure: MD Anderson Dysphagia Inventory administered pre-, post-swallow ex


* Kulbersh, Rosenthal, McGrew, duncan, McColloch, Carrol & Magnuson. (2006) Pretreatment, preoperative swallowing exercises may improve dysphagia quality of life. Laryngoscope;116:883-886.



Effects of Pretreatment Swallow Exercise on Dysphagia Quality of Life

■ Swallow Tx Protocol:

- Mendelsohn maneuver
- Shaker exercise
- Tongue-hold maneuver
- Tongue strengthening
- Falsetto exercise (in some patients)



Effects of Pretreatment Swallow Exercise on Dysphagia Quality of Life-Results

- Pts in pre-tx exercise group scored sign. higher than post-tx group on the global assessment score of the MDADI, as well as physical and emotional domains
- Trend towards significance on functional domain, tho not significant
- T stage did not impact QOL
- CXRT vs. XRT did not impact QOL
- Tumor site – pts with BOT CA had higher QOL scores than pharyngeal wall CA

Organ Preservation Tx – SLP Management – Pre-tx

- pre-treatment counseling
- bedside evaluation
 - site of tumor
 - field of radiotherapy (tumor volume)
 - lingual ROM, strength, sensation
 - jaw ROM
 - triggering of pharyngeal swallow
 - laryngeal elevation



Organ Preservation Tx – SLP Management – Pre-tx

- provide prophylactic swallow exercises
 - Jaw ROM
 - Tongue ROM
 - Tongue base ROM (gargle, tongue-hold)
 - Tongue strengthening
 - Pharyngeal constrictor ROM (tongue-hold)
 - Mendelsohn
 - Super supraglottic swallow



Radiographic study in organ preservation treatment

- define oral and pharyngeal anatomy and dynamics
- assess bolus volume effects
- assess bolus viscosity effects
- therapeutic strategies
 - maneuvers (effortful, tongue-hold, super supraglottic, Mendelsohn maneuver)
 - thermal/tactile stimulation



Therapy during/after organ preservation treatment


- ROM exercises for oral tongue, base of tongue and jaw
- lingual strengthening exercises
- thermal/tactile stimulation
- appropriate maneuvers (e.g., effortful, super supraglottic, tongue-hold, Mendelsohn, Shaker)



Organ Preservation Treatment - Speech and Voice Management

- Speech - typically not affected
- Resonance - may need a palatal lift
- Voice -
 - modify pitch, loudness, vocal effort
 - vigorous vocal fold adduction exercises are not indicated!





Long-term follow-up after organ preservation treatment

- non-compliance with voice, swallow exercises
- swallow function may deteriorate
- salivary flow may deteriorate over time (or may improve with tx)