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Tracheoesophageal Voice Restoration: Problems & Solutions

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Tracheoesophageal Voice Restoration: Problems & Solutions

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Disclosures

Julie Bishop-Leone has financial relationship or relationship affiliations to disclose:
She is employed as the Director of Clinical Education at Atos Medical, Inc. There are no other nonfinancial relationships to disclose.
Learning Objectives

• Identify the various etiologies for leakage through and around a tracheoesophageal (TE) voice prosthesis and describe the various practical means for solving these problems.
• Describe how gastroesophageal reflux affects the health of the TE puncture and the life of the TE voice prosthesis.
• Describe the assessment protocol for assessing a patient with immediate and delayed post-fitting aphonia.

Troubleshooting: Facts & Figures

Data based on St Louis University Experience

• 2/3 of the patients only require replacement of the prosthesis, mostly for mild leakage (median device life 3-4 months)
• 1/3 of the patients experience adverse events, which require special attention, but mostly are easily solvable
• Adverse events are seen in only 1 out of 9 (10.7%) replacements

Focus on the underlying CAUSE, NOT the SYMPTOM!
Problems & Solutions: Leakage through the Prosthesis

• Causes
  – Blockage of valve by mucus/crust/food
  – Improper prosthesis fit
  – Biofilm formation on valve
  – Increased intraesophageal pressure during swallow or inhalation
  – Superior tract migration

Leakage Through the Prosthesis:
Valve blockage by mucus/crust/food

• Solutions
  – Clean the prosthesis with brush and/or flush
  – If still leaking, replace prosthesis
  – Temporarily use plug
  – Consider temporary diet modifications

Video courtesy of Saint Louis University Cancer Center – Dennis Fuller
Leakage Through the Prosthesis: Too short

- Solutions
  - Resize and refit
  - Educate pt about signs of improper fit
  - voice deterioration and/or increased effort with speaking

Illustration courtesy of Elizabeth C. Ward and Corina J. van As-Brooks, Head and Neck Cancer, Treatment, Rehabilitation, and Outcomes

Biofilms on voice prostheses consist of a large variety of oral microorganisms, including streptococci, staphylococci, and yeasts

Mahieu et al., 1986

It's NOT just YEAST!
• **What is Biofilm?**
  – Free-floating opportunistic bacteria and/or fungi
  – Likes inert & rough surfaces, necrotic tissue or ischemic normal tissue
  – Extracellular polysaccharide matrix (EPS) acts as protection from drugs and it is then difficult to tx

• **Who is at risk for biofilm formation?**
  – Immunosuppressed pts
  – Diabetics
  – Pts on antibiotics and/or oral/inhaled steroids
  – Malnourished pts
  – Chemo/XRT pts
  – Pts with poor oral hygiene and/or dental caries
  – Denture users
  – Pts with xerostomia (XRT, Sjogren’s)
Suggestions & Anecdotal Treatments Used in the Field that May Prevent/Help Biofilm Formation

Williams et al., 2011

• PREVENTION IS THE KEY!
• Good Oral Hygiene
  – Brush after each meal
    • mechanical toothbrush may disrupt biofilms
    • Colgate’s Total® Toothpaste (contains Triclosan)
  – Salt & soda rinses for pts undergoing XRT
  – Clean and remove dentures each night
  – Mouthwashes as needed
    • 0.2% Chlorhexidine Gluconate – GUM® Brand doesn’t have alcohol
    • Essential Oils Mouthwash

Suggestions & Anecdotal Treatments Used in the Field that May Prevent/Help Biofilm Formation

Free et al., 2003

• Daily Cleaning of the VP
  – Brush and Flush at least twice a day and after meals (see IFU)
  – Avoid vigorous brushing of VP
Suggestions & Anecdotal Treatments Used in the Field that May Prevent/Help Biofilm Formation

**Diet**
- Avoid sugars and yeast-containing foods (i.e. beer, carbs)
- Drink buttermilk (Busscher et al., 1998)
- Probiotic liquids and supplements containing L. lactis 53 and S. thermophilus B (Free et al., 2001)
- Yakult yogurt drink (Schwandt et al., 2005)
- Honey (Alandejani et al., 2009)
- Try caffeinated drinks containing sugar – Coca Cola Classic (Free et al., 2000)

• If taking antibiotics, may want to pair with prophylactic antifungal or probiotics

**Antifungals**
- Prophylactic use?
- Chlorhexidine Gluconate
- Nystatin?
- Mycelex Troches ( clotrimazole )
- Amphotericin B Lozenges (Mahieu et al, 1986)
- Slow-releasing tablets containing miconazole nitrate (Van Weissenbruch et al., 1997)

**Anti-GERD medications**
Treating Biofilm with a Prosthesis
Hilgers et al., 2003; Soolsma et al., 2008; Graville et al., 2011; Timmermans et al., 2015

• Excessive biofilm solution
  – ActiValve, light strength

Leakage Through the Prosthesis:
Increased Intraesophageal Pressure during Swallow or Inhalation

• Indicators
  – Ruled out biofilm
  – Early device life failure of less than 1 month
  – Inadvertent opening of the valve during the swallow
  – Ingestion of air and/or gastric filling
Leakage Through the Prosthesis: Increased Intraesophageal Pressure during Swallow or Inhalation

**Solutions**
- Teach pt to lower swallowing pressure
- Evaluate and treat for stricture
- Plug can prevent in certain situations (i.e., if gastric filling only occurs under specific situations)

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Leakage Through the Prosthesis: Increased Intraesophageal Pressure during Swallow or Inhalation

**Solutions continued**
- NiD
- Increased resistance prosthesis
- Duckbill
- ActiValve
Leakage Through the Puncture Tract: Missing Prosthesis

• **Causes**
  – May have inhaled into lung (coughing – not always!)
  – Pt could have coughed out and swallowed
  – May have dislodged prosthesis while cleaning or placing a laryngectomy tube
  – Flaccid TE tract
  – Removed during medical procedure

• **Solutions**
  – Chest X-ray or flexible scope to r/o aspiration (educate your radiologist!)
  – Re-educate, resize & refit
  – May require a XtraSeal™ or BS Large Esophageal Flange (LEF)
  – Educate medical staff
  – If aspirated, NiD for safety medallion
  – Change to prosthesis with thicker retention collar or NiD with safety ring & tape or glue the strap
Periprostatic (Around) Leakage

**Causes**
- Prosthesis too long/pistoning in the tract
- Superior tract migration
- Enlarged TEP due to GERD/GPR and/or tissue issues
- Stricture

Periprostatic Leakage:
Prosthesis too Long/ Pistoning in Tract

**Solutions**
- Resize and refit
- Educate pt about signs of an improper fit
Periprosthetic Leakage: Superior Tract Migration

• **Solutions**
  - Resize and refit
  - XtraFlange, XtraSeal or BS LEF
  - NiD or duckbill
  - Glue/tape the strap to reposition TE tract horizontally
  - Surgical closure and repuncture with primary placement

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Periprosthetic Leakage: Tissue Issues

• **Causes**
  - Prolonged pistoning
  - Previous cancer TX (XRT/chemo)
  - Recurrent or metastatic disease
  - Poor thyroid function
  - Poor nutrition
  - TEP surgical technique
  - Stricture
  - Diabetes
  - GERD/GPR
  - Atrophy of party wall
GERD and Periprosthetic Leakage
Lorenz et al., 2011

• Occurs in approx. 25-45% of pts with VP
• n = 60 randomly selected pts (mean age of 64.7)
  – 44/52 XRT
  – 29/60 (48%) reported TEP problems (i.e. recurrent leakage around, enlarged TEP, & atrophy of trachea)
  – All pts received 24hr pH probe using a 2-channel sensor spaced 10cm apart with proximal sensor study placed at the level of the TEP (done at beginning of study and after 6 mos)

• Results:
  – Enlarged TEP pts had significantly more reflux events (162.2±144.3) than those without enlarged TEP (71.9±86.8) at p=0.001
  – From 2001-2005, pts were not tx’d with PPIs and 24-29 pts required invasive surgeries (i.e. pedicled flaps)
  – Since 2006, aggressive PPI treatments resulted in reduction in # of pts with leakage around & # of highly invasive procedures

Leakage Through the Prosthesis Secondary to STRICTURE
Periprosthetic Leakage Solutions

- Medical workup to uncover the underlying etiology
- Resize TE tract length
- Evaluate swallowing function as indicated
- Prosthetic modifications: XtraFlange, XtraSeal, LEF, custom washer
- Temporary removal of prosthesis to allow puncture to shrink
- Cauterization (i.e., silver nitrate)
- Purse string suture
- Injection of filling materials (i.e. collagen, Cymetra, Restylane)
- Re-evaluate TEP surgical technique
- Surgical closure and repuncture
- Diet modification
- Anti-GERD medication

Algorithm for Treating Periprosthetic Leakage

Lorenz et al., 2011

- **Minor Leakage with 8-11mm puncture diameter**
  - Replace with shorter prosthesis
  - Use of a silicone washer (Provox® XtraFlange™)
  - Custom-fit VP with large esophageal flange
  - Aggressive proton pump inhibitor (PPI) therapy

- **Substantially Enlarged TEP with >11mm diameter**
  - Use injectable augmentation material (i.e. GMCSF, collagen, Cymetra, Radiesse)
  - If injectable fails, remove VP for 7-14 days, insert cuffed trach tube and NPO
  - Aggressive PPI therapy
  - If all of above fail, then close TEP surgically
  - Purse string suture?
Periprosthetic (Around) Leakage: Considerations

- **Puncture Evaluation:**
  - Prosthesis too long?
  - Shape of puncture?
  - Position of puncture?
  - Location of leakage?
  - TEP atrophy?

- **Functional Evaluation:**
  - Dysphagia?
  - Stricture?

- **Medical Evaluation:**
  - Recurrent or metastatic disease?
  - Diabetes?
  - Hypothyroidism?
  - Malnutrition?
  - Evidence of GERD/GPR?

Problems & Solutions:
Immediate Post-fitting Aphonia

- **Causes**
  - Overfitting or underfitting
  - Prosthesis valve is closed
  - Hood of the prosthesis is abutting the posterior esophageal wall
  - Forceful stomal occlusion
Immediate Post-fitting Aphonia:
Overfitting and Underfitting

• VP embedded in tracheal or esophageal mucosa
• VP may also be extruded

• Solutions
  - Remove prosthesis, stent tract, and resize tract
  - Insert measuring device flush against tracheal wall before retracting to read the size;
  - Check open tract voicing (voicing should be consistent)
  - Insert correct length voice prosthesis and/or rest site if indicated (48 hr) with red rubber catheter

Immediate Post-fitting Aphonia:
Prosthesis Valve Closed

• Solutions
  • Insert brush into prosthesis
  • Remove the prosthesis and inspect valve, if indicated
Immediate Post-fitting Aphonia: Prosthesis Hood Abutting Posterior Esophageal Wall or Forceful Occlusion

Solutions:
- Place prosthesis with smaller or no hood
- Practice “gentle” occlusion
- Put on Provox® FlexiVoice™ or HME with Titanium Cap to reduce pressure on prosthesis during voicing.

Immediate Post-fitting Aphonia: Assessment Protocol

- Ensure proper fit
- Put brush through the prosthesis
- Check for pressure during stomal occlusion
- Remove prosthesis and assess valve function and open tract voicing
Delayed Post-fitting Dysphonia/Aphonia:

• **Causes**
  - Prosthesis valve is closed
  - Prosthesis not fully inserted
  - TE tract stenosis/closure
  - Granulation
  - Infection
  - False tract
  - Separated party wall

• **Solutions**
  - Remove prosthesis
  - Re-dilate & confirm tract direction
  - Replace prosthesis
  - Dilate 1-2 sizes up or longer duration
  - Loading tube
  - Capsule

Delayed Post-fitting Aphonia:
Prosthesis Not Fully Inserted

• **Solutions**
  - Remove prosthesis
  - Re-dilate & confirm tract direction
  - Replace prosthesis
  - Dilate 1-2 sizes up or longer duration
  - Loading tube
  - Capsule
Delayed Post-Fitting Dysphonia/Aphonia:
TE Tract Stenosis/Closure

**Solutions**
- Remove prosthesis
- Check voice
- Water/leak test
- Medical management as indicated
  - Antibiotics
  - Topical steroid cream
  - Cauterization
  - GERD meds
- Allow puncture tract to heal:
  - Catheter
  - Softer prosthesis
- Resize and refit

Delayed Post-Fitting Aphonia:
Separated Party Wall

**Indicators**
- Gradually deteriorating voice
- Difficulty inserting the prosthesis
- Unable to advance catheter or dilator
- Misaligned tract
- 2 “pops” with the sizing device
- TE tract significantly increases

**Solutions**
- Use catheter instead of dilator
- Avoid unnecessary replacement
- Antibiotics as needed
- Retrograde placement of prosthesis
- KEY: appropriate sizing (flush against TEP)

**Causes** Trauma, Infection, XRT
Delayed Post-fitting Aphonia:
Assessment Protocol

1. Ensure proper fit
2. Put brush through the prosthesis
3. Remove prosthesis
4. Dilate
5. Assess TE voice with an open tract
6. If fluent, then prosthetic or mechanical problem
   - Resize
   - Choose appropriate type of prosthesis
   - Refit
   - Immediate Post-Fitting Aphonia Protocol if indicated
7. If nonspeaker or nonfluent, then physiologic problem
   - Dilate tract
   - Assess what the physiologic problem could be
   - Check open tract again
   - Medical management as indicated

Accidental Dislodgement

- Don’t panic!
- Pt. should lean forward and cough to make sure that prosthesis is not lodged in airway
- Once Pt. is breathing easily, insert catheter in puncture
- Tie exposed end off so that gastric juices do not leak out
- Tape to neck
- If prosthesis wasn’t located, go to hospital for chest xray to ensure that prosthesis is not in the lung
Granulation Tissue

**CAUSES**
- Inflammation secondary to frequent removal of prosthesis
- Irritation/rubbing from prosthesis
- Chronic GERD (Pattani et al. 2009)

**TREATMENT**
- Remove granulation tissue
- Clean prosthesis in situ and remove only due to difficulties voicing or leakage
- Ensure correct fit of TEP
- Mometasone Furoate
- Silver Nitrate
- Anti-GERD meds

Pharyngeal Constrictor Hypertonicity/Spasm

**Indicators**
- Strained, tight, effortful voicing
- Inability to produce voice
- Tight & dysfluent voice with or w/o prosthesis
- Elevated intraesophageal pressure during objective insufflation testing
- No dysphagia or stricture
- Patent TE tract
- Voice improvement following pharyngeal plexus lidocaine block
Pharyngeal Constrictor Hypertonicity/Spasm

- **Solutions**
  - Therapeutic lidocaine block
  - Botox
  - Dilation
  - Myotomy
  - Manual manipulation

1. Inject 5% Lidocaine solution (CP segment) without Epinephrene
2. Diagnostic fluoro study (in lateral & AP view)
   - Mark high and low margins of stricture
   - Select mid-point
3. High dose injection of Botulinum Toxin (100 plus mouse unit dose)
4. EMG used to measure action potentials.
Hypotonicity

• **Indicators**
  - Voice often intermittent wet/gurgly
  - Soft, weak and/or breathy voice

• **Solutions**
  - Digital pressure
  - Pressure band
  - Head positioning
  - Stomal occlusion vs. hands free speech
  - If only during hands-free speech use FreeHands Stomal Support

Gastric Bloating

• **Causes**
  - Increased esophageal pressure causing air inhalation through voice prosthesis
  - Aerophagia
  - Resulting from hypertonicity/spasm which forces air inferiorly during voicing
  - Stricture
Gastric Bloating

- **Solutions**
  - Use duckbill, NiD, increased resistance prosthesis or ActiValve
  - Use plug if indicated
  - Teach patient to swallow with less pressure
  - If severe, physician referral (GI should be consulted)

### Studies Referenced

Studies Referenced


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