Fluoroscopic Swallow Study Predictors of Tracheoesophageal Puncture Voice Quality

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OBJECTIVE

Tracheoesophageal puncture (TEP) is the gold standard for voice rehabilitation after total laryngectomy (TL). TEP voicing can be challenging & unpredictable. The dynamic swallow study is a fluoroscopic swallow study part of standard clinical care prior to TEP placement.

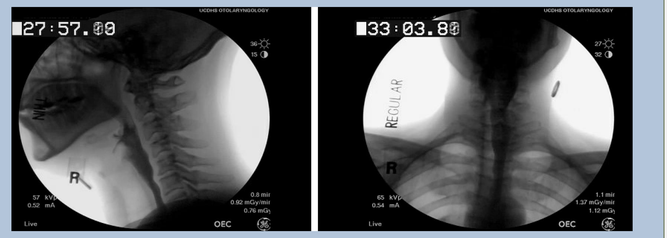

Figure 1: Pre-laryngectomy fluoroscopic study demonstrating mild dysphagia consistent with late radiation effects characterized by mild residue in the vallecula and pyriform sinus. Biomechanical impairments includes narrowing of the PES segment at the level of C5-C6.

Our study aimed to determine which **objective dynamic swallow study (DSS) parameters** predict **improved voice outcomes** in patients who have TEP placement.

METHODS

Existing patient list utilized from Evangelista et al. (2021)

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Patients screened to include those who have had TEP voicing for >= 3 months

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Collected basic demographics, clinical parameters, DSS parameters pre- and post-laryngectomy, and SLP voice ratings

→ Excluded patients with active head & neck cancer, unresolved TEP complications, or insufficient data

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Statistical analysis performed – multivariate linear regression for pre- and post-laryngectomy DSS data to assess correlation with global voice ratings

RESULTS

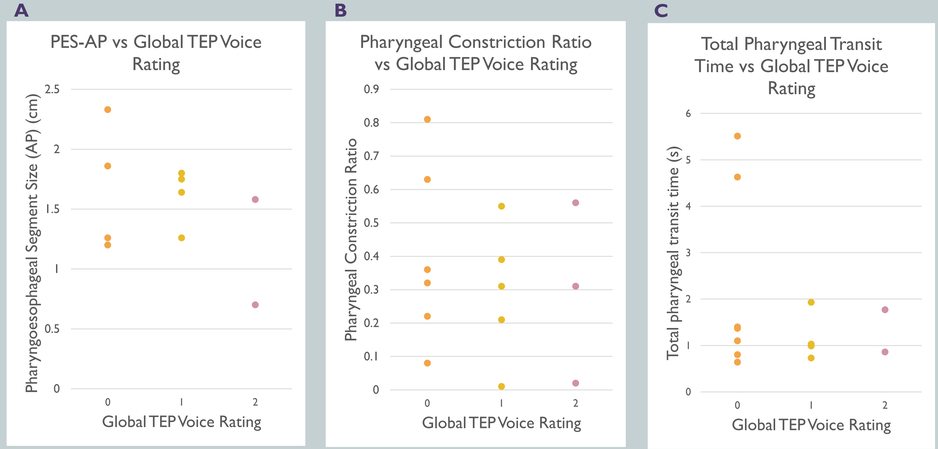
N=14 patients had full data set for pre- and post-laryngectomy DSS parameters and SLP-voice ratings:

Patient Characteristic	Global Voice Rating		
N=14 (total)	Below Average	Average	Above Average
Age			
43-70 years (N=7)	43%	43%	43%
70+ years (N=7)	43%	14%	14%
Dysphagia			
Yes (N=13)	46%	31%	23%
No (N=1)	0%	100%	0%
History of acid reflux (Y/N)			
Yes (N=2)	0%	100%	0%
No (N=10)	40%	30%	30%
N/A (N=2)	100%	0%	0%
Complications since TEP placement			
Yes (N=5)	60%	20%	20%
No (N=9)	33%	44%	22%

Table 1: Breakdown of demographic information and clinical parameters collected. Age distribution is split evenly in each age group, with most patients experiencing dysphagia. Below average = global TEP score of 0; average = global TEP score of 1; above average = global TEP score of 2.

N=14 (total)	Global Voice Rating		
Comorbidities	Below Average	Average	Above Average
Aspiration Pneumonia (N=2)	7%	7%	0%
GERD (N=1)	0%	7%	0%
Heart Disease (N=7)	21%	21%	7%
Hypertension (N=7)	21%	21%	7%
Hypothyroidism (N=4)	14%	14%	0%
Hyperlipidemia (N=2)	7%	7%	0%
Lung Disease (N=7)	29%	7%	14%
None (N=1)	0%	0%	7%

Table 2: Highlights the comorbidities found in the patient population examined. Most common comorbidities include hypertension and heart disease, primarily in patients with below average to average global TEP voice scores.



Est. Std. -1.6356, error 0.2292, t-value -7.135, p > 0.00084

Est. Std. -1.6591, error 0.5126, t-value -3.237, p > 0.023

Est. Std. -0.3957, error 0.1088, t-value -3.637, p > 0.015

Figure 3: Multivariate linear regression demonstrated pre-laryngectomy fluoroscopy measures **(A)** pharyngoesophageal segment size (AP) (β=-1.6356; [95% CI, 0.10-1.0.35];p<0.05), **(B)** pharyngeal constriction ratio (β=-1.6591;[95% CI, 0.05-0.71];p<0.05) , and **(C)** total pharyngeal transit time (β=-0.3957;[95% CI, 0.51-0.89];p<0.05) to be independent predictors of global TEP voice ratings. $F(6,5) = 19.68$ $p < 0.0025$ $R^2=0.9106$.

CONCLUSIONS

- We found the following pre-laryngectomy fluoroscopy parameters to be independent predictors of global TEP voicing:
  1. **Pharyngoesophageal segment size (AP)**
     1. As PES size size ↓, Global TEP Voice Rating ↓
  2. **Pharyngeal constriction ratio (PCR)**
     1. As PCR ↓, Global TEP Voice Rating ↓
  3. **Total pharyngeal transit time**
     1. As total pharyngeal transit time, Global TEP Voice Rating ↓
- No independent predictors found in post-laryngectomy dynamic swallow study measurements.
- Future studies should explore prospective voice rating modalities for a more accurate voice rating score. Additionally, a larger sample size is necessary to further investigate the findings of this study.

REFERENCES

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