

Pharyngoesophageal Segment Behavior in Esophageal and Tracheoesophageal Speech: A Review of Determining Aspects of Vocal Outcome

Ana Carolina Ghirardi^{1*}, Andrey Ricardo da Silva²

¹Department of Speech-Language Pathology and Audiology, Federal University of Santa Catarina, Florianópolis, SC, Brazil

²Department of Mechanical Engineering, Laboratory of Vibrations and Acoustics, Federal University of Santa Catarina, Florianópolis, SC, Brazil

Keywords: voice quality; laryngectomy; pseudoglottis; voice rehabilitation

Introduction

The Pharyngoesophageal Segment (PES) provides the voice source for totally laryngectomized patients. Variations in this structure's geometric and mechanical properties account for the difficulty in understanding its behavior during speech, crucial in providing clinical guidelines in voice rehabilitation, to predict therapeutic success and improve overall vocal outcome. As the fibers of the PES vibrate in both Esophageal (ES) and Tracheoesophageal (TES) speech, studies do not often compare this structure's behavior during the two forms of speech, considering them to occur in a similar manner. However, given that the *source of air* for voicing is different in ES e TES, it is reasonable to assume that the PES may behave differently in these two types of speech, accounting for the widely recognized difference in vocal outcomes and therapeutic success. Most studies focus on esophageal speech production and understanding the behavior of the PES during tracheoesophageal speech may aid in clinical management of speech rehabilitation of laryngectomized patients who use a tracheoesophageal prosthesis, and in understanding why the vocal failure rate is still fairly high in these cases. Thus, the **aim** of this paper is to conduct a discussion based on a literature review of the characteristics of the PES that directly influence speech in esophageal and tracheoesophageal speakers.

Methods

Literature Review Study, based on the guideline question: *How do the shape, position, pressure, tone, number of vibrating segments and symmetry of the mucosal wave of the PES during speech influence vocal outcome in esophageal and tracheoesophageal speakers?* A search for papers using predetermined keywords and boolean operators was conducted on the Scopus, Web of Science, Medline, and Pubmed databases. Papers were screened by title and abstract and those repeated in multiple databases, not available in either English, Portuguese, Spanish, French or Italian or did not address the guideline question were eliminated. Papers that met the predetermined criteria were read entirely and those that addressed the guideline question were included in the final sample for analysis. All steps were undertaken separately by two researchers and any doubts regarding the inclusion or exclusion of papers was solved by a third reader. There was no limitation regarding dates of publication.

Results and Discussion

The search yielded a total of 828 studies. 804 were excluded after all steps were completed. 24 studies were included for providing insight regarding the influence of specific characteristics of the behavior of the PES on voice production, assessed during speech. Different methods were used depending on the date of publication and aim, including x-ray, videofluoroscopy, esophageal insufflation, esophageal manometry, and stroboscopy. All studies related specific aspects of PES behavior to speech outcome, and mostly, for analysis, speakers were divided by an SLP into two separate groups: *good* and *poor* speakers, using different methods and scales, mostly based on perceptual criteria. There was little differentiation between overall speech performance and/or intelligibility and voice quality which, frequently, prevented more detailed analyses on voice. There may be a slight change in position of the PES (generally upward) in both ES and TES. In different voicing tasks (high/low pitch and strong/soft voice), there are changes in the shape of the PES, particularly in ES. Muscle tone plays an important role in voice onset in ES and in voice quality and phonation time in TES. Symmetric mucosal waves yield less hoarse and/or breathy voice quality for both groups. PES shape was not related to vocal outcome in ES, but, in TES, circular or oval PES tended to yield 'better' voice quality. Studies agree that pressure in the PES plays a major role in both ES and TES. In TES, pressure distribution along the esophagus is more significant in voice than pressure at rest at the upper esophageal sphincter, an important parameter for esophageal speakers. There is need for more specific criteria in assessing vocal quality in ES and TES so that surgeons, doctors and voice clinicians can better predict vocal outcomes, manage eventual setbacks and improve overall voice quality for laryngectomized patients.

Acknowledgements

FINEP/Brazil for grant number 01.16.0044.00(0346/15) and the National Council for Scientific and Technological Development (CNPq) – Brazil.

References

- [1] Búa *et al*, Annals of otology, Rhinology and Laryngology, 126(2):138-145, 2017.
- [2] Isman *et al*, Head and Neck, 1992; 352-358.
- [3] van As *et al*, Arch Otolaryngol Head Neck Surg 1999; 125: 891-897
- [4] Aguiar-Ricz *et al*, J Voice 2007; 21(2): 248-256

