ORIGINAL ARTICLE

Monaural performance intensity functions of average esophageal speech

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ABSTRACT

Aim of the study

The aim of the present study was to compare performance-intensity functions of average esophageal and normal speech in quiet and at various signal-to-noise ratios.

Methods

The individuals who participated in this investigation included twenty native Modern Greek adult listeners (10 males and 10 females). All subjects had pure tone thresholds of ≤ 15 dB HL at all octave frequencies ranging from 250 Hz to 8000 Hz. with no known history of auditory dysfunction or neurological disorder. The speech stimuli used for both conditions in this experiment were four 50-bisyllabic-word lists. For the esophageal speech stimuli, all 200 words were recorded in an Industrial Acoustic Company booth meeting ANSI S3.1 standards, by one male esophageal speaker. Each word was produced several times and two judges (speech pathologists) rated the repetitions of each word for perceived quality of production, and the best production of each word was selected. Testing was conducted in a sound isolated booth with all stimuli presented monaurally (right ear). Each list was presented monaurally starting at 0 dB HL and ascending in 5 dB HL steps to minimize nonauditory factors such as memory effects. In addition, the order of the presentation of words within each list was randomised for each subject and for each intensity level. Word recognition scores were assessed in quiet and under 5 different signal-to-noise ratios. These repeated measures were analysed by mixed models with random effects and using pseudo variables.

Results- Conclusions

Our results indicated that listeners performed significantly better in quiet than in noise, however, word recognition scores for the esophageal speech stimuli were poorer for both conditions.

Keywords:

Performance-intensity function, esophageal speech, signal-to-noise ratio, monaural.

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INTRODUCTION

Laryngectomy, which involves the surgical removal of the larynx, causes the respiratory tract to be separated from the vocal tract. Consequently, breathing now occurs via the tracheostoma, an opening that is created by attaching the trachea to the skin of the neck. After laryngectomy, one of the most important objectives is voice restoration. Currently, there are three methods to achieve voice rehabilitation in these patients: esophageal voice, tracheoesophageal voice and artificial larynx.[1] The artificial larynx is recommended only when the patient is unable to achieve esophageal voice.

Alaryngeal voice production is comparable to laryngeal voice production, because both rely on the combination of a driving force and vibrating tissue. In esophageal voicing, air is injected from the oral cavity into the esophagus, thus insufflating the esophagus beneath the neo-glottis which is the new voice source. This injected air is then released, and causes the neo-glottis to vibrate[1]. The neo-glottis is situated at the entrance to the esophagus and it is formed by the same structures as the upper esophageal sphincter. Thus, the source of vibration is composed of mucosa and musculature that is normally present in this area, such as the cricopharyngeal muscle and the constrictor pharyngeus muscles.[2]

Compared to the larynx, the alaryngeal voice source can at best be described as a grossly controlled structure. However, control of the alaryngeal voice source may not be as consistent as control of the larynx. It therefore seems reasonable that the auditory quality of alaryngeal speech will be negatively affected.