

Acoustic and Perceptual Analysis of the T.E.P Speech with Different Types of Prosthesis

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Voice restoration following laryngectomy remains a challenging problem for both speech pathologist and Head Neck surgeon. It is, however, the key to return laryngectomees to productive life. Different methods for the restoration of voice following laryngectomy have been developed such as oesophageal speech, electronic/artificial larynx. But with the development of T.E.P. technique (Singer and Blom, 1980), T.E. speech has become a widely accepted method of alaryngeal speech rehabilitation. T.E. speech is achieved when pulmonary air is directed through the prosthesis to vibrate the RE. segment and produce voice. At first Blom-Singer's duck-bill prosthesis was developed. Later many prosthesis were developed in different parts of the world to overcome the drawbacks of existing prosthesis. So there was a need for studies producing information on different prosthesis in terms of acoustic and perceptual parameters. In this study it was possible to study B.S. duck-bill prosthesis, B.S. low pressure prosthesis and Indian prosthesis all being used by the same subject and they were compared with normal speakers in terms of acoustic and perceptual parameters.

The voice and speech sample from 5 T.E. speakers under three conditions (i.e. 3 types of prosthesis) and 5 normal speakers were collected. These were analyzed using computer programs and judges to obtain 21 parameters (acoustic, temporal, spectral and psychoacoustic).

The results were subjected to statistical analysis using nonparametric statistical test -wilcoxon test for matched pairs (paired T-test). The following conclusions were drawn based on the statistical analysis.

- I. The speech of T.E. speakers with prosthesis were less acceptable and intelligible than the normal laryngeal speech. Among the T.E. speakers no significant differences were observed in terms of acceptability across prosthetic conditions and even in terms of intelligibility exception L.P. aided T.E. speakers, which significantly differed from the D.B. aided T.E. speakers.
- II. 1. D.B. aided T.E. speakers didnot differ significantly from the normal laryngeal speaker on the following parameters :-
 - a. Fundamental frequency in speech
 - b. Frequency range in speech
 - c. Falling time
 - d. Vowel duration
 - e. Voice onset time (VOT) (for / / & /K/)
 - f. Formant frequencies
 - g. Alpha Ratio
 - h. Beta Ratio
 - i. Gamma ratio

2. L.P. aided T.E. speakers did not differ significantly from the normal laryngeal speaker on the following parameters :-
 - a. Frequency range in speech
 - b. Falling time
 - c. Vowel duration
 - d. (VOT) (for /t/ & /k/)
 - e. Formant frequencies
 - f. Alpha Ratio
 - g. Beta Ratio
 - h. Gamma ratio
 3. IP. aided T.E. speakers did not differ significantly from the normal laryngeal speaker on the following parameters :-
 - a. Fundamental frequency in speech
 - b. Vowel duration
 - c. VOT
 - d. Formant frequencies
 - e. Alpha Ratio
 - f. Beta Ratio
 - g. Gamma ratio
- III
1. D.B. aided T.E. speakers differed significantly from the L.P. aided T.E. speakers on the following parameters.
 - a. Fundamental frequency in phonation

- b. Intensity range in phonation
 - c. Vowel duration (Only for /V vowel)
 - d. Intelligibility
 2. D.B. aided T.E. speakers differed significantly from the I.P. aided T.E. speakers on the following parameters.
 - a. Frequency range in speech
 - b. Frequency range in phonation
 - c. Maximum phonation duration
 3. L.P. aided T.E. speakers differed significantly from the I.P. aided T.E. speakers on the following parameters.
 - a. Fundamental frequency in speech
 - b. Frequency range in speech
 - c. Intensity range in phonation
 - d. Maximum phonation duration

It is evident from the above finding that low pressure prosthesis aided T.E. speech is better than Duck-bill and Indian prosthesis aided where as Indian prosthesis aided T.E. speech is better than Duck-bill prosthesis aided. This means that increased airflow resulting from use of the low pressure prosthesis had a positive impact on the parameters studied.