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PERCEPTUAL ASSESSMENT OF TRACHEOESOPHAGEAL (TEP) VOICE

Objectives:
To assess the TEP voice using perceptual and subjective parameters and compare the voice parameters of persons with TEP at one week & one month post-surgery. To compare the voice parameters of persons with TEP with those having normal voice and to note the time taken for voice/speech assessment.

Material and Methods:
A total of 14 males participated in the study. Among them seven had underwent total laryngectomy surgery followed by a secondary TEP placement; seven age-matched persons with normal larynx/voice served as a control group. Voice/speech of the subjects was assessed while they performed six speech/voice tasks. The performance was analyzed perceptually and semi-objectively by experienced speech pathologists.

Results& Conclusion:
The voice/speech parameters of persons with tracheoesophageal prosthesis showed improvement at one month post-surgery as compared to one week post-surgery. The parameters of TEP voice at one month post-surgery were comparable with normal voice. It is recommended that this voice/speech assessment battery may be used in clinical practice for quick assessment of voice of persons with TEP prosthesis.

Key words: laryngectomy, tracheoesophageal, speech, voice prosthesis

INTRODUCTION:

Total laryngectomy (TL) significantly alters speech production. For a speech production system to be functional, the following 3 basic elements are necessary: a power source, a sound source, and a sound modifier. For laryngeal speakers, lung air is the power source, the larynx is the sound source, and the vocal tract (ie, pharynx, oral cavity) is the sound modifier. During total laryngectomy (TL), the sound source is removed and the lungs are disconnected from the vocal tract. Successful voice restoration following total laryngectomy requires identification of an alternative sound source with a viable power source. The three basic options for voice restoration after total laryngectomy are artificial larynx speech, esophageal speech, and tracheoesophageal speech. Selection of a method should be based on input from the surgeon, speech pathologist, and patient. The decision is best made keeping in mind the patient's communicative needs, physical and mental status, and personal preference. Tracheoesophageal speech is based on a surgical fistula created in the wall separating the trachea and esophagus. This puncture tract can be created primarily, at the time of total laryngectomy, or secondarily, weeks or years following the total laryngectomy . Several days after surgery, a one-way valved prosthesis is placed in the puncture tract, allowing lung air to pass into the esophagus. The lung air induces vibration of the pharyngoesophageal (PE) segment for sound production. The mechanics of the one-way valve allow lung air to pass into the esophagus without food and liquids passing into the trachea. During the initial evaluation, a speech pathologist measures the length of the puncture tract and selects a size and style of prosthesis for placement. Once in place, the patient digitally occludes the tracheostoma to direct air through the prosthesis into the esophagus for phonation. Hands-free external airflow valves are also available as accessories. The air supply for speech is pulmonary, phonation sounds are natural, and voice restoration occurs within one-two weeks of surgery. Additional surgery is required for secondary punctures, the prosthesis must be maintained, and aspiration may occur if liquids leak through a malfunctioning valve are the disadvantages of TEP.

There are limited numbers of centers providing the option of TEP to the laryngectomized patients especially in the northern part of India. The present study was designed to provide a perceptual assessment of the TEP voice parameters which could be carried in a brief time period in an effect way.

The aims and objective of this study was to assess the TEP voice using perceptual and subjective parameters and compare the voice parameters of persons with TEP at one week post surgery with those at one month post surgery. To compare the voice parameters of persons with TEP with those having normal voice.To note the time taken for voice /speech assessment.

MATERIAL AND METHODS:

A total of 14 male subjects participated in the study. Among them seven persons had underwent total laryngectomy surgery followed by a secondary TEP placement by the ENT surgeon at the Goverment, Medical College and Hospital, Chandigarh and seven age matched persons with normal larynx and voice served as a control group. All the subjects were explained about the purpose of the study, and after obtaining a written consent, their speech/voice was recorded and analyzed by experienced speech pathologists. The time taken to complete the voice/speech assessment was noted. All the subjects were asked to perform six speech/voice tasks. These included-phonation of vowel /a:/ for as long as possible in one breath; sustaining /s/ and /z/ sounds; counting from one to ten in one breath, reading a passage. The subjects were asked to speak spontaneously for 2-3 minutes on one of the topics like daily routine or ones own family. High quality dual-cassette stereo recording system was used to record the speech/voice samples on high quality audio cassettes . The speech recordings were performed in sound treated rooms of the Audiology and Speech Rehabilitation Unit of Department of ENT. During the analysis the cassette was replayed and the time taken by each subject to complete various speech/voice tasks was recorded using a stopwatch.

RESULTS:

The data were then subjected to statistical analysis by student t-test, average and range. The parameters assessed for TEP voice group at one week post surgery and one month post surgery and for normal voice are shown in table1. The student t-test showed that the difference was not significant between the voice performance of TEP voice at one month post surgery and normal voice, while there was a significant difference between the voice performance of TEP voice group at one week post surgery and at one month post surgery for parameters 1,2,3,4. The difference was not significant between the voice

performance of TEP voice at one month post surgery and the normal voice group for parameters 1,2,3, but was significant for parameter 4 (Table 1).

Table 1: Voice Parameters for TEP and Normal Voice.

S.No.	Voice Parameter	Voice Performance		
		TEP Voice		Normal Voice
		1 week post surgery	1 month post surgery	
1	MPT /a:/ Average Range	14s 5.87-34.32s	19s 10.24-39.33s	22s 16-25.13s
2	s/z ratio	0.8	1	1
3	Time taken (in seconds) for Counting 1-10	11s	4.5s	4s
4	Counting in one breath	Till 3	Till 28	Till 46
5	Loudness	Low Medium Loud	Low Medium Loud	Low Medium Loud
6	Overall Speech Intelligibility	Good Fair Poor	Good Fair Poor	Good Fair Poor

Average time taken for the voice / speech assessment was 12.5 minutes, it was in the range of 9-14 minutes.

DISCUSSION:

The maximum phonation time for TEP voice users was 14s in an average and 5.87-34.32s range at one week post-operative. It was 19s average and 10.24-39.33s range at one month post-operative. Whereas, for normal laryngeal speakers it was average 22s and range16-25.13s. This is in agreement with Massimiliana Carello and MauroMagnano who reported an average of 17.30s of maximum phonation time and a range of 4.67-48.45s for TEP voice users.[1] The difference was statistically significant between one week post surgery and one month post surgery voice performance. It was statistically not significant between one month post surgery and normal voice performance. The s/z ratio was 0.8 at one week post surgery which was an indication of voice pathology (ISHA battery), but it was one at one month post surgery indicating normal voice production (ISHA battery). The persons with normal voice had a s/z ratio of one. This was in agreement with the normative data provided for Indian population (ISHA battery).Time taken (in seconds) for counting 1-10 was 11s at one week post surgery than 4.5s at one month post surgery and the difference was statistically significant (Table 1). The difference was not statistically significant between one month post surgery (4.5s) and normal voices (4s). Counting in one breath was less (till a count of 3) at one week post surgery than at one month post surgery (till a count of 28) and the difference was statistically significant. The difference between counting in one breath at one month post surgery (till a count of 28) and normal voice was also statistically significant (till a count of 46). This indicates that the pulmonary/lung capacity of TEP voice users needs to be improved. Thus providing a direction for putting effort during speech/voice therapy. According to the perceptual/subjective assessment the loudness of TEP voice was 'low' at one week post surgery; it was 'medium' at one month post surgery, while it was loud for normal voices. Daniilidis et al, reported that on the parameters of duration of phonation, volume of voice in dB and counting, prosthesis performed better than the esophageal speech.[4] Overall Speech Intelligibility was perceptually adjudged to be 'fair' at one week post surgery, it was 'good' at one month post surgery for TEP voices. Kesteloot et al, reported that TEP speakers had better speech quality than the esophageal or electro-larynx speakers and that TEP speakers acquired new voice faster than others.[5]

CONCLUSION:

The voice and speech parameters of persons with tracheoesophageal prosthesis showed improvement at one month post surgery as compared to one week post surgery. The parameters of TEP voice group at one month post surgery were comparable with normal voice group. The time taken for the voice/speech assessment was brief, it could be completed in about 12-13 minutes. It is recommended that this voice/speech assessment battery may be used in clinical practice for quick assessment of voice of persons with TEP prosthesis.

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