CLINICAL REPORT

Long Term Rehabilitation of a Total Glossectomy Patient

Gurmit Kaur Bachher · Kanchan P. Dholam

Abstract Malignant tumours of the oral cavity that require resection of the tongue result in severe deficiencies in speech and deglutition. Speech misarticulation leads to loss of speech intelligibility, which can prevent or limit communication. Prosthodontic rehabilitation involves fabrication of a Palatal Augmentation Prosthesis (PAP) following partial glossectomy and a mandibular tongue prosthesis after total glossectomy [1]. Speech analysis of a total glossectmy patient rehabilitated with a tongue prosthesis was done with the help of Dr. Speech Software Version 4 (Tiger DRS, Inc., Seattle) twelve years after treatment. Speech therapy sessions along with a prosthesis helped him to correct the dental sounds by using the lower lip and upper dentures (labio-dentals). It was noticed that speech intelligibility, intonation pattern, speech articulation and overall loudness was noticeably improved.

Keywords Glossectomy · Tongue and palatal augmentation prosthesis · Articulation · Deglutition · Rehabilitation

Introduction

Prosthodontic management of articulation disorders form a critical part of a post-surgical intervention program. Skelly reported the adaptive speech patterns of partial and total glossectomees [2]. Shimodaira's reports on the speech with palatal augmentation prosthesis (PAP) in total glossectomy without perceptual & acoustic analysis [3]. Kaplan, reported effect on deglutition and psychological profile with complete dentures and a mandibular tongue prosthesis following total glossectomy [4]. The wide band spectrographs of "two" and "five", by Izdebski K, showed improved vowel formants and partial transitions in total glossectomy patient [5].

Literature on the effect of tongue prosthesis on deglutition and nature of speech enhancement in Indian conditions is not sufficient. Hence, the attempt to report a case of total glossectomy rehabilitated with a tongue prosthesis for facilitating swallowing and speech skills.

Clinical Report

A fifty-nine year old edentulous male patient (SS) presented with squamous cell carcinoma of the tongue ($T_4N_0M_0$). This patient underwent total glossectomy, with a bilateral modified neck dissection and reconstruction with a pectoralis major myocutaneous flap on 5th December, 1991. This was followed by radiation therapy.

Complete dentures with an artificial tongue made of molloplast-B (DETAX, GmbH & Co. KG, Roonstr 23a, D-7500 Karlruhe1 W—Germany) attached to a mandibular denture was given to the patient in September 1992. Fabrication of prosthesis was done with routine prosthetic procedures. Wax trial and patient's speech was assessed with the help of Dr. Speech Software Version 4 (Tiger DRS, Inc., Seattle). This software allows the user to record, analyze and display the acoustic signals. The programme will automatically compute statistical information and plot

G. K. Bachher
Department of Speech Therapy, Head and Neck Services, Tata Memorial Hospital, Mumbai, Maharashtra State, India

K. P. Dholam (✉)
Department of Dental and Prosthetics Surgery, Tata Memorial Hospital, Dr. E. Borges Road, Parel, Mumbai 400 012, Maharashtra State, India
e-mail: kdholam@hotmail.com

Fig. 1 Denture with tongue prosthesis fabricated in molloplast-B

Fig. 2 Intraoral view of prosthesis, open mouth

a voice profile from sustained vowel and continuous speech. This is an objective, non-invasive method to evaluate acoustic signals. Wax addition and deletion was done to achieve optimum voice rehabilitation. The tongue shape was made to fit the natural palatal contour (Figs. 1, 2).

Assessment of deglutition with tongue prosthesis and therapy

The patient used the prosthesis regularly for 12 years. At the end of this period, SS's deglutition was assessed with (WP) and without (WOP) the tongue prosthesis. A questionnaire designed for assessing deglutition based on dietary habits of Indians (Bachher GK, 1993, un-published observations) was utilized in this study [6]. The questionnaire consists of information on evaluation of deglutition, salivation, status of the mandible and teeth in relation to pre-disease level. Deglutition evaluation indicated that without a natural tongue it was impossible for SS to eat even semisolid food. Food pocketing in the mouth and drooling were also observed.

Materials and Methods

The patient was given instructions, demonstration and a brief practice period of 5 min before recording the speech, for evaluating speech skills. He was given three tasks to perform namely,

1) To say the vowel "ee" at his normal modal frequency, and then at conversational loudness and asked to sustain it for at least 5 s.
2) To say, "kaap", "keep", and "kuup", to evaluate his voice parameters during articulation.
3) To read a passage in an Indian language for the duration of 15 s which consisted of phonetically balanced words.

All these tasks were recorded and analyzed using the multidimensional computerized speech analysis software, Dr. Speech.

The voice sample was recorded through a hi-fidelity unidirectional condenser microphone. Each recording was done at mouth-to-microphone distance of 3 inches. Dr. Speech software program analyzed the voice parameters as shown in the tables. Table 1.

Results

The tongue prosthesis was a substitute for a natural tongue. Though this prosthesis was rigid, not mobile as the natural tongue, it helped to improve deglutition. The therapy focus was on facilitating swallowing water sip by sip gradually shifting to liquids with increased viscosity and density followed by semisolids. The prosthesis could be removed and washed easily. Drooling was controlled with the help of oral exercises.

Discussion

Prosthetic and Speech Rehabilitation

In the absence of the tongue and hypoglossal nerve, the laryngeal elevation is altered, thus resulting in changes of acoustic parameters. The tongue and palatal augmentation prosthesis again created changes in the vocal tract resulting to changes in the resonating system.

The patient had severe dyslalia (articulation disorder) following surgery. Articulation assessment WOP indicated that the most common errors were substitutions of consonants e.g. affricates and fricatives were weakly affected. Velaric sounds were substituted by dental sounds e.g./k/–/t/. Palatal sounds (palatal stops such as t, d) were affected. There was also de-aspiration of aspirated sounds. Bilabials

Table 1 showing speech performance (parameters) with prosthesis (WP) and without prosthesis (WOP) for all the three tasks

	Habitual frequency (in Hz)		Intensity (in dB)		Jitter		Shimmer		MPT (in seconds)	
	WP	WOP	WP	WOP	WP	WOP	WP	WOP	WP	WOP
"ee" vowel	163.63*	191.54	60.42*	67.85	0.16*	0.83	0.75*	3.25	8.29*	3.37
"kaap" "keep" "kuup"	184.91*	164.99	60.57*	55.61	1.06*	1.89	0.82*	2.36	6.89*	4.08
Reading Passage	159.38*	171.02	64.42*	59.08	0.88*	2.17	1.36*	2.77	7.08*	3.96

* Indicates better parameters

and nasals were not affected. After fabrication of the prosthesis daily speech training sessions consisting of deglutition and speech exercises were arranged. Objective voice evaluation was not done as the software was not available in the institute. Subjective deglutition assessment revealed that he was able to swallow liquids only. Six months later he was trained to swallow semisolids. He attended speech therapy session during his follow up visits for the next five years.

The prosthesis was replaced after 12 years. On availability of the software, acoustic assessment of the patient's speech was done in Speech Lab (Tata Memorial Hospital, Mumbai, India 2004). It was noticed that speech intelligibility, intonation pattern, speech articulation and overall loudness was noticeably improved. Jitter and shimmer were markedly decreased. Patient also felt that his voice was more stable and better resonated, even during continuous speech. Airflow control was achieved due to this prosthesis. The upper denture which served as a PAP helped in improving pronunciations of palatal and affricate sounds. Speech therapy sessions along with a prosthesis helped him to correct the dental sounds by using the lower lip and upper dentures (labiodentals).

The patient was very comfortable with the prosthesis. His rate of speech was normal, and was carefully pronouncing all the words from the passage of task 3 .

Summary

A tongue prosthesis forms a vital part of rehabilitation of total glossectomees. A static tongue alters the oral cavity sufficiently for the patient to gain control, over deglutition and speech. Rehabilitation with tongue prosthesis appeared to help the patient in developing compensatory strategies for effectively managing soft bolus. The detailed acoustic analysis and perceptual analysis of speech provides considerable insights toward the altered articulatory dynamics of the patients using an artificial tongue.

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