SPEECH AFTER GLOSSECTOMY

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Introduction

Glossectomy is the surgical removal of all or part of the tongue, usually performed to treat carcinoma of the tongue. If larger parts of the tongue are missing, oral vegetative functions are severely impaired. A variety of symptoms arise which may interfere with speech production, intelligibility of speech, and swallowing.

Very few studies dealing with speech after glossectomy have been published (see however LaRiviere et al, 1975; Massengill et al, 1970; Morrish, 1984). We are not aware of any pre- and post treatment studies.

In a recently started research program "Speech after glossectomy", we intend to examine the phonetic characteristics of speech following total or partial resection of the tongue. Special attention will be paid to compensatory articulation in relation to the type and extent of tongue resection. This paper presents acoustic and perceptual data from a pilot study of two subjects.

Data Collection

Subjects were one normal speaker (OE) and one glossectomized speaker (PAT), both male and with the same dialect. PAT underwent radical glossectomy and neck dissection 6 years prior to this investigation.

Speech samples used in this pilot study are a word list and three short text passages. The word list is made up of 51 words with the structure /CV:l/. (C = all morpheme-initial phonemes; V = /i:/, /a:/ and /u:/).

Data Analysis

Wide band spectrograms were made of each CVC-word and the lexically stressed vowels /i:/, /a:/ and /u:/ in the text material. Based on this, the mean and standard deviation were calculated for the first two formants.

Perceptual Study. 14 students with normal hearing listened to the randomized CVC- syllables, their task being: a) to identify the first consonant and b) to identify the vowel. They heard the tape twice; half of the group was asked to identify the consonants first, the other half was asked to identify the vowels first.

Results and Discussion

Acoustical Analysis

Mean values for the first two formants of the vowels /i:/, /a:/ and /u:/ are plotted in figure 1. Looking at the F_1 versus F_2 plot, one can see that PAT's vowel structure is shifted to a more "neutral" position compared to the normal speaker's. Values for F_1 seem to be more stable than values for F_2.

For both speakers vowels in running speech are reduced compared to vowels in words in isolation.

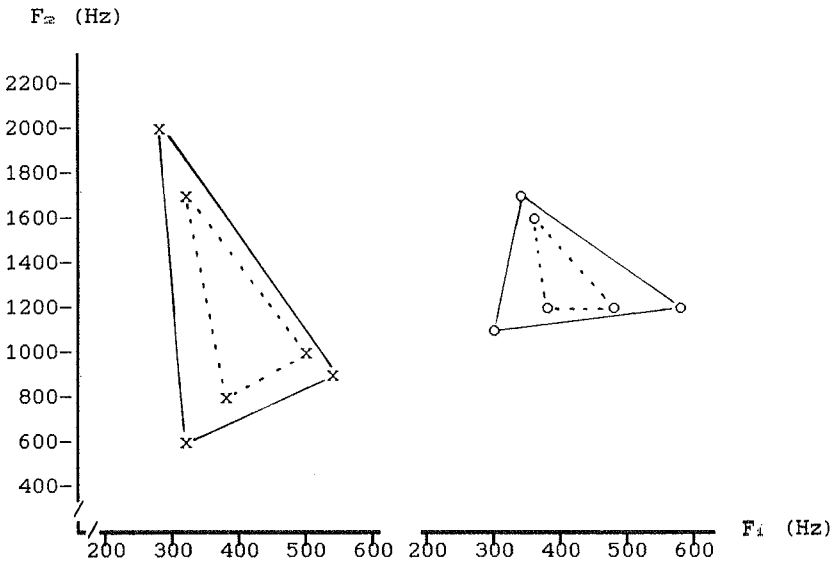

Fig. 1. F_1 versus F_2 plot for the vowels /i:/, /a:/ and /u:/ produced by a glossectomized speaker PAT (o) and a normal speaker OE (x). Mean values from word list (solid line) and running speech (dotted line).

The glossectomized subject seems to produce most consonants with the lips. Acoustic measurements reveal considerably less differentiation between consonants than the normal speaker. Formant transitions are rather flat. A representative example is given for /ba:/, /da:/, and /ga:/ in figure 2.

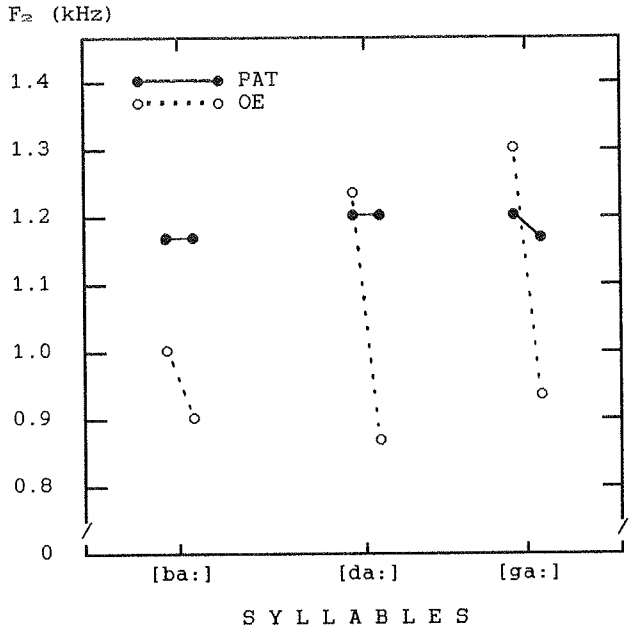

Fig. 2. Formant frequencies (F_2) for [ba: da: ga:], measured at the initial locus and target of the vowel. Normal speaker (OE) dotted line and glossectomized speaker (PAT) solid line.

Perceptual Analysis

Results from perception of consonants produced by PAT are summarized in a confusion matrix (Table 1). The figures repeat percent of listener responses (14 listeners). As expected, the labial sounds were well identified. Non-labial sounds were often perceived as labials, but to a lesser extent than expected. Apparently PAT compensates for the missing tongue articulation. The acoustic correlates of this effect will be examined in future work.

The vowels were identified to almost 100 %. This was on the other hand an easy task, since the listener panel was forced to choose between only three vowels. If the task had been to identify more vowels, the responses may have been different.

Table 1. Confusion matrix for consonants produced by the glossectomized speaker (PAT).

INTENDED CONSONANTS \ PERCEIVED CONSONANTS	p	t	k	b	d	g	f	v	s	ç	ɧ	h	j	l	r	m	n
p	93	5	2														
t	43	40	2				15										
k	50	26	7				15	2									
b				98	2												
d				83	15			2									
g				79	21												
f							98				2						
v					2			71					7	5	15		
s							67		5	2	26						
ç							93			7							
ɧ							86			2	10	2					
h												100					
j								12					17	28	43		
l					2			44					10	10	34		
r							2	14					12	27	45		
m																74	26
n																66	34

References

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